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An assessment framework and review of Newfoundland east and south coast herring stocks to the spring of 2009

Un cadre d'évaluation et un examen des stocks de harengs des côtes est et sud de Terre-Neuve jusqu'au printemps 2009

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ABSTRACT

Newfoundland east and south coast herring stocks have been assessed biannually since 2002. This document describes a special assessment conducted in the fall of 2009. The purpose of the assessment was two-fold: 1) to review the current state of scientific knowledge of the population dynamics of these herring stocks and to develop an assessment framework for the five-year period from 2010 to 2014; and 2) to assess the stocks to the spring of 2009. Each of the following components were reviewed and recommendations were made: stock structure, commercial catch data, commercial sampling protocols, aging protocols, growth and maturation, indices of abundance, models to assess stock status, precautionary approach, and ecosystem approach to fisheries. Performance reports were used to describe current stock status and short term prospects. For White Bay–Notre Dame Bay, stock status improved from 2002 to 2005 and has remained stable since then. For Bonavista Bay–Trinity Bay, stock status improved from 2002 to 2007 but deteriorated in 2008 and again in 2009. For St. Mary's Bay–Placentia Bay, stock status deteriorated from 2001 to 2004, and has remained stable since 2005. For Fortune Bay, stock status deteriorated from 2001 to 2006, and has remained stable since then.

RÉSUMÉ

Depuis 2002, les stocks de harengs des côtes est et sud de Terre-Neuve ont fait l'objet d'une évaluation bisannuelle. Le présent document rend compte d'une évaluation spéciale menée à l'automne 2009. L'évaluation visait deux objectifs : 1) constater l'état actuel des connaissances scientifiques relatives à la dynamique des populations de ces stocks de harengs et mettre au point un cadre d'évaluation pour la période de cinq ans de 2010 à 2014 et 2) évaluer les stocks jusqu'au printemps 2009. Chacune des composantes suivantes a été évaluée et des recommandations ont été formulées : la structure des stocks, les données sur les prises commerciales, les protocoles d'échantillonnage de la pêche commerciale, les protocoles pour déterminer l'âge, la croissance et la maturation, les indices d'abondance, les modèles d'évaluation de l'état des stocks, l'approche de précaution et l'approche écosystémique de la gestion des pêches. Des rapports sur le rendement ont servi à rendre compte de l'état actuel des stocks et des perspectives à court terme. L'état des stocks de la zone baie White – baie Notre Dame s'est amélioré de 2002 à 2005 et s'est maintenu depuis. L'état des stocks de la zone baie de Bonavista – baie de la Trinité s'est amélioré de 2002 à 2007, mais s'est dégradé en 2008 et encore en 2009. Pour la zone de la baie St. Mary's – baie de Plaisance, l'état des stocks s'est dégradé de 2001 à 2004 et est resté stable depuis 2005. En ce qui a trait à la zone de la baie de Fortune, l'état des stocks s'est dégradé de 2001 à 2006 et est resté stable depuis.

OVERVIEW

This document provides the necessary information to review the current state of scientific knowledge of the population dynamics of Newfoundland east and south coast herring and to develop an assessment framework for the five-year period from 2010 to 2014.

Herring research within the Region has had a long history dating back to the mid 1960s. The following individuals have contributed greatly to the knowledge base:

- Vince Hodder 1965–71
- George Winters 1969–98
- Al Hourston 1966–68
- Scott Parsons 1968–72
- John Moores 1972–83
- Mike Giles 1973
- Doug McKone 1974–78
- Edgar Dalley 1978-~90
- John Wheeler 1979–present

Current information on the following components was reviewed:

- Stock structure
- Commercial catch data
- Commercial sampling protocols
- Aging protocols
- Growth and maturation
- Indices of abundance
- Models to assess stock status
- Precautionary approach
- Ecosystem approach to fisheries

The review was timed to coincide with the release of recommendations by the Fisheries Resource Conservation Council in their report titled: "Fishing into the future: the herring fishery in eastern Canada" (Anon. 2009).

The review also provided advice on the current status and future prospects of each stock for 2010 and 2011.

FISHERIES RESOURCE CONSERVATION COUNCIL HERRING REPORT

In 2008, the Fisheries Resource Conservation Council (FRCC) was asked to identify the major risks to the sustainability of the herring fisheries and to develop a long-term strategic approach to herring conservation that would promote sustainable use of the resource.

The FRCC released its report in August 2009; some of its recommendations included:

1. The FRCC recommends that all catches of herring be recorded and reported, including those for bait, as well as discards and wastage.
2. The FRCC recommends that DFO and industry ensure the provision of sufficient scientific information and advice to support the management of herring fisheries. Each stock should have at least one reliable index of stock size.

3. The FRCC recommends that DFO and industry identify priorities for expanded scientific study of herring and its role in the ecosystem. New scientific studies should include not only data collection but also analyses, reporting, and discussion with partners up to and including the formulation of advice.

7. The FRCC recommends that all *Integrated Fishery Management Plans* for herring be renewed. Revised plans should outline a decision-making process that is participatory, transparent and accountable. The goals and objectives must be clear and measurable.

8. The FRCC recommends the implementation of an Ecosystem Approach to Fisheries (EAF) for decision making to improve fisheries management in Canada. The Council recommends that this approach be initiated in an area such as 4VWX where the existing stewardship arrangements are strong and the quality of the data available is relatively good.

One recommendation (# 1) is the responsibility of Policy and Economics Branch. Two recommendations (#'s 2 and 3) are specifically targeted towards Science. These, plus recommendations 1, 7, and 8 were discussed during this review.

STOCK STRUCTURE

IDENTIFICATION OF FIVE STOCK COMPLEXES

Five herring stock complexes have been identified within the coastal waters of east and south Newfoundland (Fig. 1). These are White Bay-Notre Dame Bay (WB-NDB), Bonavista Bay-Trinity Bay (BB-TB), Conception Bay-Southern Shore (CB-SS), St. Mary's Bay- Placentia Bay (SMB-PB), and Fortune Bay (FB). The nomenclature for these areas has been "bay" based rather than by NAFO area as some stock complexes cross NAFO boundaries. In addition to these stock complexes, herring occur along the south coast from Cape Ray to Pass Island; these are considered to be localized stocks and are not considered to inter-mix much with adjacent stocks in Fortune Bay and NAFO Div. 4R. Herring are also distributed along the southern coast of Labrador during the summer months; these are considered to be a combination of local stocks and migrants from WB-NDB, or possibly from Div. 4R.

The five stock complexes were defined from tagging experiments conducted mostly in the late 1970s; there have been no tagging experiments since 1986 (Wheeler and Winters 1984a). These experiments indicated substantial intermingling of local populations within the bays, primarily during the summer and early fall. This was due to northward feeding migrations in the summer and southward migrations in the fall to over-wintering grounds. During the early 1980s, spring spawners dominated in most areas and populations tended to be most discrete during the spring spawning season. Homing rates were high; in excess of 75 % of herring returned to the same area to spawn in successive years (Wheeler and Winters 1984b). Although it was determined that multiple spawning stocks existed within each stock complex, the complexes were defined based upon the timing of fisheries. For stocks along the northeast coast (WB-NDB, BB-TB, and CB-SS), the primary fishery (i.e. purse seine) occurred during late fall as herring returned to over-wintering areas. For southeast coast stocks (SMB-PB and FB), fisheries occurred during the over-wintering and spring periods.

There have been no studies since the early 1980s designed specifically to address stock structure. The Barry Group Inc. conducted three reconnaissance surveys in 2006 along the southwest coast of Newfoundland (Wheeler et al. 2006). These surveys were designed to determine the presence/absence of herring for a potential commercial fishery. Science participated in the surveys. There were two goals: 1) to determine the biological characteristics

of sampled herring, and 2) to determine the origins of sampled herring through tagging and trace element analysis. Herring were caught in one set only, and the number caught (93 fish) was insufficient to tag or conduct trace element analysis.

It is unknown if migrations and stock relationships identified in the early 1980s still exist today. Substantial changes have occurred to herring populations in the intervening period. Stock sizes are smaller now. Spring spawners are no longer dominant in most areas (except FB) and fishers have noted changes in migration patterns, in particular delays in the timing of traditional fisheries (Appendices 1–3).

Research Recommendations

1. Consideration should be given to re-examining stock relationships. Of particular concern is the degree of discreteness between spring and autumn spawning components, especially in WB-NDB and BB-TB stock areas.
2. Traditional tagging experiments may no longer be practical, mainly due to low levels of fishing effort. Alternative approaches should be considered:
    - Genetic markers
    - Trace element analysis
    - Acoustic tags
3. Investigate fully the apparent shift in dominance from spring spawners to autumn spawners in the two northern stock areas to determine the nature of the change, its cause, and implications for the ecosystem and for fisheries management.

COMMERCIAL CATCH DATA

POLICY AND ECONOMICS BRANCH DATA

Policy and Economics Branch provides commercial landings data (t), by bay, month and gear type (Tables 1–6 and Fig. 2). Landings data are available by stock area since 1966; TACs were first implemented by the precursor of Fisheries and Aquaculture Management Branch in 1977. Data for the three most recent years are considered preliminary. For 2009, some but not all landings are available to October 22nd.

The Statistics Division of Policy and Economics Branch collects, evaluates, and reports information obtained from a variety of sources within the fishing industry:

1. DMP (Dockside Monitoring Program Reports): Independent verification of fish landed, including species, weight, condition, area of capture, etc. by vessel at the time of off-loading.

2. HAILS: Daily reports of fishing activity and estimates, by species and area fished, received from vessels while at sea, and in-season weekly reports from buyers of amounts purchased for specified fisheries.

3. LOGS: A required record completed by fishers in some gear sectors that provides day to day fishing activity, such as estimates by species, area fished, amount of gear used and time the gear was fished for each fishing trip.

4. PURCHASE SLIPS: Receipts issued to fishers by fish buyers for each landing, including information such as species type, amount of catch purchased, price per unit, area fished, etc.

Commercial statistics since 1996 do not include landings for bait purposes. Policy and Economics Branch personnel have indicated that bait catches were included in the commercial statistics from 1970 up to and including 1995 (Anne Marie Russell, pers. comm.). It is uncertain if bait catches were included prior to 1970. As noted in the FRCC report (recommendation # 1), the exclusion of bait catches from commercial statistics represents a source of uncertainty, especially for those areas and years where bait catches form the bulk of landings.

ESTIMATION OF HERRING CAUGHT AND USED FOR BAIT (1996–2009)

An annual telephone survey has been conducted by Science since 2006 of herring gill net licence and/or bait permit holders. Sample sizes are selected to provide a 10 % margin of error for all areas combined, assuming an 80 % response rate. This survey is described in detail in the Indices of Abundance section in this document. The objectives of the survey are two-fold: 1) to determine how many herring gill net licence and/or bait permit holders fished in the current year, and 2) to obtain observations of herring abundance and other information from those that did fish. From these surveys, 95 % of active fishers indicated that they fished for bait only (Table 7). Consequently, catches of 95 % of active gill net fishers are not included in annual landings data.

Estimates of bait catches by fisher and by area were calculated for 2007 and 2009 from estimates of catch provided by active fishers for these years (Table 8). The mean bait catches per fisher from 2007 and 2008 were used to estimate bait catches by area from 1996 to 2006. The 2009 estimate was not available when this calculation was done. Sample sizes (number of fishers) in 2007 and 2008 ranged from 17 in SMB-PB to 51 in FB.

Herring are used as bait primarily in the lobster fishery and to a limited extent in the snow crab fishery (Dave Taylor, pers. comm.). During the 2009 lobster RAP, fishers from NDB, PB and FB affirmed that herring was the bait of choice for the lobster fishery.

With few exceptions, pot restrictions have remained constant in all lobster fishing areas since 1998 (Roanne Collins, pers. comm.). The notable exception was in PB (LFA 10) where the number of pots per fisher decreased from 300 to 200 in 2003 (Table 9).

A list of active lobster fishers was available for the period from 1998 to 2006 (Kim Penney, FAM). Information was not available for 1996 and 1997. A fisher was deemed to be active when lobster landings were recorded against his/her Fisheries Identification Number (FIN). This list may not be complete as some fishers sell their lobsters privately and such catches would not show up against a FIN (Roanne Collins, pers. comm.).

Bait estimates from the 2007 and 2008 telephone surveys were then used to back-calculate for the period from 1996 to 2006 (Table 9). The 2007 and 2008 bait estimates were averaged by stock area. They were then applied to the numbers of active fishers (from 1998 to 2006) to estimate total bait catches in these years. Results for 1998 were applied to 1996 and 1997. With the exception of PB, no correction was required for number of pots per fisher.

The annual estimates of total bait (1996 to 2006) were available by stock area only. For simplification, these were added to the respective annual May gill net landings (Policy and Economics Branch data) in NDB, TB, PB, and FB. The selection of month (May) was logical as

most of the lobster fishery occurs in May. The selection of bay to which bait estimates were added was arbitrary, e.g.: NDB rather than WB. Total bait estimates for WB-NDB could have been apportioned by bay; however, the percentage by bay would also have been arbitrary.

There are several assumptions with estimation of total bait. Most importantly, it assumes that all active lobster fishers caught their own herring to use as bait. This is not the case as some unknown percentage of fishers buy their bait. These herring would have been caught in a commercial fishery and included in reported landings. It also assumes that the 2007 and 2008 bait estimates are accurate. These estimates are provided verbally by a sub-sample of active fishers. As inter-annual estimates within stock areas varied by up to 29 %, results were averaged over two years. Inter-stock differences within years were as much as 66%; for example, in 2008 SMB-PB = 1315 kg vs. FB = 2184 kg. This may be related to lobster abundance. If abundance is greater in FB than in SMBPB, then it may take longer and require more bait to harvest the exploitable lobster population. If so, then this assumes that this difference is consistent through the 1996 to 2006 time period. The estimation also assumes that herring were available consistently through the time period. Fishers will use other fish as bait (e.g.: flounder), if herring are not available. Also, if some fishers sell their lobsters privately, this will lead to an under-estimation of total bait catches.

The estimation was made prior to the 2009 telephone survey results being available. If a three year average (2007-09) had been used to back calculate, bait estimates would have been within 10 % of those derived using the two year average.

Research Recommendations

1. Use the calculated estimates for 1996–2006; use telephone survey estimates from 2006 onward, until better estimates are available.
2. Test to see the impact of using mean bait estimates from more telephone surveys, as they become available. For example, if a three year average (2007-09) had been used, bait estimates would have been within 10% of those derived using the two year average.
3. Use information from the 2007 to 2009 telephone surveys to re-examine the calculated estimates for 1996–2006 in an attempt to account for lobster fishers who purchased bait rather than fished for bait themselves.

ESTIMATION OF HERRING THAT ARE DISCARDED DEAD IN THE HERRING FISHERY

Herring can be discarded dead from all principal gear types used in the herring fishery: purse seines, tuck seines, bar seines, traps, and gill nets. Estimates of dead discards are available from purse seines only. However, over the past ten years (1999–2008), purse seines have accounted for 40 % of reported landings within the assessed stock areas.

A telephone survey has been conducted annually since 1996 to collect biological and fishery related information from herring purse seine fishers. This survey is described in detail in the Indices of Abundance section in this document. The survey is designed to collect information from all active purse seine fishers in WB-NDB, BB-TB, and SMB-PB; there is no purse seine fishery in FB. On average, over the 13 year time series, 87 % of active fishers have been interviewed. As part of this survey, each fisher is asked to provide an estimate of total landings, an estimate of total discards, and an estimate of discard survival rate. From these data, a removal to landing ratio has been calculated (Table 10). This ratio has ranged from 1.00–2.37, with a mean of 1.10. The annual ratio, by stock area, has been applied to annual monthly purse seine landings (1996–2008), by stock area, to estimate removals.

There is obviously a degree of subjectivity to this estimation as fishers first have to estimate total discards and then provide an estimate of discard mortality. This estimation is very difficult, if not impossible, to verify. Estimates of total landings can be compared with dock side monitoring reports; however, estimates of discards cannot be verified in a similar manner.

Research Recommendations

1. The estimation of dead discards is difficult for fishers to quantify and difficult for anyone else to verify. Given that the average rate of dead discards in the purse seine fishery is 10 %, and given that it is for part of the time series for one gear only, this correction should not be made.
2. Continue to collect discard information for the purse seine fishery and any other fishery for which discard information is available.

ESTIMATION OF HERRING CAUGHT AS BY CATCH IN OTHER FISHERIES

Herring are caught as by catch in other fisheries, primarily fisheries for capelin (purse seine, tuck seine, and trap) and mackerel (purse seine, tuck seine, bar seine, and gill net). However, they are also caught occasionally in shrimp trawls, squid traps, and cod gill nets.

Herring by catch is recorded by Policy and Economics Branch if it is provided on DMP forms or on purchase slips for those fisheries not covered by DSM. It is unclear what percentage of herring by catch is recorded.

There are also estimates of herring by catch in capelin traps from a Science logbook program that was conducted from 1981 to 1999 (Anon. 2001). These data have not been evaluated.

Research Recommendations

1. Investigate new information sources that may now be available containing herring discard and by-catch data and evaluate their potential for providing more precise catch data on herring removals.

ESTIMATION OF THE BY CATCH OF OTHER SPECIES IN THE HERRING FISHERY

The principal commercial species caught as by catch in the herring fishery are: mackerel, cod, salmon, and flounder. As with herring by catch, Policy and Economics Branch records such by catch if it is provided on DSM forms or on purchase slips for fisheries not covered by DMP. It is unclear what percentage of by catch is recorded.

There are also estimates of the by catch of other species in the Science research gill net program data base. This program is described in detail in the Indices of Abundance section of this document. In this program contracted fishers are required to haul a fleet of research gill nets daily for a specified period each spring and to record herring catches and the by catch of other species. Annual by catch estimates are available for SMB-PB and FB since 1982 and for WB-NDB and BB-TB since 1988. These data have not been evaluated.

Research Recommendations

1. Estimates of the by-catch of other species in herring gill nets are available in the herring research gill net data base since 1982. Although this information is not required to estimate herring abundance, it should be evaluated to address by-catch issues.

COMMERCIAL SAMPLING PROTOCOLS

BIOLOGICAL SAMPLING

Biological samples are collected annually from random samples of the various commercial herring sectors. The protocol is to collect one random sample per 500 t landings, by gear, by month, and by bay (i.e. WB, NDB, BB, TB, SMB, PB, and FB). A sample consists of 50 fish. Samples are collected by Pelagic Section personnel from various sources, primarily fish processors and fish harvesters. Samples are frozen and returned to the Northwest Atlantic Fisheries Centre (NAFC) for subsequent processing.

The following parameters are recorded for each of the 50 fish within a sample: record type, species, year, month, day, vessel, gear, sample origin, area, locality, NAFO Division, sample type, preservation, sample number, specimen number, length, whole weight, gutted and gilled weight, sex, maturity, gonad weight, spawning type, age, and stomach fullness.

Data from these samples (age, spawning type, and mean whole weight) are used to construct annual commercial catch-at-age vectors by spawning type and stock area. Ideally, if the sampling protocol is met, a sample would be available per 500 t landing, by gear, month and bay. However, due to various reasons, this protocol cannot normally be met. Samples must be procured from fish plants and fishers at a cost to Science (purchase price, travel, processing etc.). Consequently, sample procurement is rationalized to minimize costs. In most cases, samples are available from the major annual fisheries, but sometimes are not available from smaller fisheries. On average, samples are available for greater than 80 % of the reported landings each year.

In the event that a sample is not available for a particular cell (gear/month/bay) another sample must be applied to the landing within that cell. In such cases, the following criteria are used:

- 1st criterion: same gear, same season (spring, summer, fall, winter), same bay.
- 2nd criterion: similar gear (e.g.: purse seine and tuck seine), same season, same bay.
- 3rd criterion: same or similar gear, different season, same bay.
- 4th criterion: same or similar gear, same season, different bay (within stock area).
- 5th criterion: same or similar gear, different season, different bay.

In 2008, 1623 herring were sampled from the commercial fishery to calculate catch numbers at age for 7240 t of catch. For FB (Table 14) criterion # 2 was used.

In some cases, Policy and Economics Branch may attribute catch to an incorrect cell. In 2008, 106 t was attributed to purse seines in March in SMB. However, a sample was collected from a purse seine catch in March in PB. In all likelihood, this catch was improperly coded from a DMP report and will be corrected later based upon a purchase slip. The catch from the preceding year (by gear, month, and bay) must be checked to ensure that all corrections are accounted for.

An annual commercial catch numbers-at-age vector, by stock area and spawning type, is calculated when sample groupings have been determined for each cell. The catch (t) for a particular cell is converted to fish numbers using the mean whole weight (spring and autumn spawners combined) from the appropriate sample. Fish numbers are apportioned by age using the sample numbers-at-age, by spawning type. This process is repeated for all cells; cell numbers-at-age are then summed to provide catch numbers-at-age for the stock area.

Commercial catch-at-age is available by stock area and spawning type from 1970 to 2008 (Tables 11–14 and Figs. 3–6). The 2009 commercial fisheries were ongoing in some areas; therefore, 2009 samples have not been processed. Catches-at-age from 1996 to 2007 have been revised since the last assessment (Wheeler et al. 2008) to account for herring discards in the purse seine fishery and herring used as bait in the lobster fishery. This has impacted both the age distribution and spawning type percentages in most areas (Figs. 7–10). Catches-at-age from 1970 to 1995 includes estimates of herring used as bait but do not include estimates of herring discards in the purse seine fishery.

The revision of the commercial catch-at-age is not without concerns. By adding the bait estimates to the May landings in one bay (of two bay stock areas), it assumes that the sample(s) applied to that landing applies to the entire stock area. This is unlikely as the bait estimate should be apportioned in some way between the two bays. There are also concerns regarding the addition of discard estimates to a portion of the catch matrix only (1996–2008). This is ameliorated to some degree as dead discards, on average, represent approximately 10 % of the purse seine catch.

Research Recommendations

1. Evaluate the strengths and weaknesses of random versus stratified-random sampling design with respect to collection of age and length samples for herring.
2. Evaluate the minimum sampling requirements for herring with emphasis on the number of samples per ton of catch as well as the number of fish per sample. The practicality of collection within human resource constraints should also be taken into account.

AGING PROTOCOLS

ASSIGNMENT OF AGES AND SPAWNING TYPES

Currently, herring are sampled annually from commercial fisheries and from the research gill net program. In 2008, 5380 specimens were sampled; all specimens were aged.

Ages are assigned based upon examination of annulus formation on the otolith. Annuli are characterized by white, opaque, separate rings encircling the otolith. Otoliths are first fixed into a depression on black acrylic plates, using 1,2 - dichloroethane. The otolith is then covered with a drop of ethanol. The acrylic plate is placed under a microscope and the otolith is viewed under the appropriate magnification. The determination of age is made by counting the number of summer rings on the rostrum area of the otolith. It is sometimes necessary to count rings on two or more areas of the otolith. Every effort is made to exclude the fish length when determining ages. Comparisons with samples from the previous year are also avoided until a particular bay or stock area is completed.

Spawning type is assigned based upon a combination of age, maturity stage, otolith characteristics, and season of capture. Herring are classified into two groups, spring and autumn spawners, relative to the time of year they spawn or were spawned. Spring spawners are those fish that spawn during the spring months (April to June) and autumn spawners are those fish that spawn during the fall months (September to November). Spring-spawner otoliths are characterized as having small, white, opaque, convex nuclei. Age determination for spring spawners involves counting the nucleus and subsequent summer rings, but excluding any summer growth (plus growth) in the year the fish is caught. Autumn-spawner otoliths are characterized as having larger, translucent, concave nuclei. Age determination for autumn

spawners involves counting the summer rings and adding one extra year for the nucleus, but excluding any summer growth (plus growth) in the year the fish is caught. Plus growth can be evident on otoliths of both spring and autumn spawners as early as June, especially for younger fish.

Herring usually mature at ages 3–5. Spring spawners, caught from April to early June, would normally be maturity stages 4, 5, or 6, with gonads of 70–80 grams or larger, depending on fish size. However, they may also be maturity stages 7 (emptied sack) or 8 (spent 3–8 grams). Autumn spawners, caught in late July to October would normally be maturity stages 4, 5, or 6, with gonads of 70 - 80 grams or larger depending on fish size. However, they may also be maturity stages 7 (emptied sack) or 8 (spent 3–8 grams).

By convention the birth date for any herring is January 1st in the year it is caught. The intense summer feeding period produces an opaque summer annulus. This can be present as early as June in young fish or July depending on area. When counting the rings during age determination, the summer annulus (plus growth) would not be included until the following January 1st date.

The herring otolith collection within the Region dates back to 1966. Since 1966, there have been only three principal age readers: Ray Chaulk and Clayton Barbour from 1966 to 1983, Ray Chaulk until 1995 Ray Chaulk and Brad Squires in 1994 and 1995, and Brad Squires from 1996 to the present.

Research Recommendations

1. Quality control exercises should be implemented (e.g. re-reading samples) and statistically analyzed to examine for errors and their potential effects on stock assessment advice.
2. A reference digitized collection of otoliths should be established.
3. A second age reader should be trained within the Pelagic Section to read herring otoliths.

GROWTH AND MATURATION

Wheeler et al. (2009) have provided a recent review of temporal changes in maturation, mean length-at-age, and condition of spring spawning herring in Newfoundland waters. Maturation age and size decreased substantially in the late 1980s, approximately a decade after a precipitous decline in herring abundance. Length-at-age and body condition decreased concurrently with changes in maturation. These changes supported the hypothesis of evolutionary changes in maturation. However, increases observed in the most recent year classes and concurrent changes in other species, suggest that changes in the environment may have also affected age and size at maturation.

Mean weights-at-age are available by stock area and spawning type from 1970 to 2008 (Tables 15 – 18 and Fig. 11). Only those samples collected from January to June were used in order to minimize intra-annual growth effects. These samples were derived from commercial fisheries and from research initiatives. The same weight-at-age matrix was used for both catch and stock in ADAPT and SURBA calibrations (see Models to Assess Stock Status section in this document for further information).

Research Recommendations

1. Examine changes in the L_{50} and A_{50} with environmental changes using degree days as a proxy for environmental conditions.
2. Examine the impact of combining research and commercial samples on the development of weights-at-age.

INDICES OF ABUNDANCE

Seven abundance indices have been documented for east and southeast Newfoundland herring in the most recent (2008) assessment of these stocks:

- spring research gill net catch rates 1982–present
- fall research gill net catch rates 1980–1991
- acoustic biomass estimates 1983–2000
- gill net logbook catch rates 1996–present
- gill net logbook index (from logbooks) 1997–present
- gill net fisher index (from telephone surveys) 2006–present
- purse seine fisher index (from telephone surveys) 1996–present

The spring and fall research gill net catch rates are age disaggregated by spawning type; all other indices are age aggregated. Acoustic biomass estimates are as absolute; all other indices are considered proportional to total biomass.

RESEARCH GILL NET PROGRAM (SPRING AND FALL RESEARCH GILL NET CATCH RATES)

This program was initiated in the fall of 1980 to provide standardized age disaggregated abundance indices independent of the commercial fishery. It was started before acoustic technology was widely available to estimate fish biomass. It was also started at a time when spring spawning herring dominated (in the commercial fishery) in most areas (Fig. 12).

The program was first initiated during the fall of 1980 in WB-NDB and BB-TB. It was reasoned that the program would intercept spring and autumn spawning herring as they migrated to over wintering areas. At the time, there was also a fall commercial gill net fishery in these areas and it was possible to recruit fishers for the program. The fall program was extended to CB-SS in 1983. Unfortunately, there wasn't a fall gill net fishery in SMB-PB or FB. Therefore, a spring research gill net program was established in these areas in 1982. The spring program was designed to intercept spring spawners prior to spawning. A similar spring program was initiated in CB-SS in 1985 and in WB-NDB and BB-TB in 1988. In 1991, Science was faced with the first of many program reductions. Funding was no longer available to continue with spring and fall programs in WB-NDB, BB-TB, and CB-SS. It was decided to cut the fall program and retain the spring program, similar to SMB-PB and FB. At this time, it was also becoming more difficult to retain fishers for the fall program as the demand for gill net caught herring was declining and consequently, the fall commercial gill net fishery in these areas was also declining. The spring program was cut for budgetary reasons in CB-SS after 1996. The spring program continues to the present in WB-NDB, BB-TB, SMB-PB, and FB. In most cases, fishers under contract to the research gill net program are also involved in the lobster fishery; i.e. they either use herring as bait for the lobster fishery themselves, or they provide herring to other fishers to use as bait.

Since 2002, the number of fishers under contract annually to the research gill net program has ranged from 26 to 29; in 2009 there were 27 fishers. From 1988 to 2002, the number ranged from 20 to 23 (Table 193). Fishers must possess a commercial fixed gear herring licence to be eligible for an experimental licence, a requirement of DFO Licencing. This has been an impediment as lobster fishers are good candidates for the program but quite often do not qualify because they have a herring bait permit, but not a commercial fixed gear herring licence.

Fishers are contracted each spring to provide catch rate data and biological samples of their catch. Each fisher is provided with a standardized fleet of five herring gill nets; the stretched mesh size of these nets measure 50.8 mm, 57.2 mm, 63.5 mm, 69.9 mm, and 76.2 mm respectively. Each net is 32 m long and 200 meshes (~9 m) deep, with the exception of the 50.8 mm mesh net, which is 150 meshes (~5 m) deep. These nets are fished from a fixed location. Prior to 2009 nets were fished for a period of one month; in 2009, this was extended to 45 days. This coincides with the spawning season for spring spawning herring, at a time when stock mixing is considered to be minimal. Fishers are required to haul the nets once a day (weather permitting) for the duration of the contract, to maintain an accurate daily log record of their catch numbers (by net), and to collect and freeze specified samples of their catch at twelve regular intervals during the contract.

Multiple locations are fished annually in each stock area. In 2009, there were eight in WB-NDB, nine in BB-TB, six in SMB-PB and four in FB (Fig. 13). Over time, some locations have been changed. This is inevitable due to fishers retiring or leaving the program for other reasons. When a fisher leaves the program, the first criterion is to replace him with a fisher from the same community. If this is not possible, a fisher is recruited from the same general area. Spatial coverage is maintained to ensure an adequate distribution of effort throughout each stock area.

In 2009, fishers were required to provide 12 samples, two per week, during the 45 day contract. This represented a 50 % increase from previous years when fishers were required to provide 8 samples, during a 30 day contract. A sample consists of a maximum of 50 fish, 10 per net. The 10 fish are selected randomly from the catch for a particular net and are bagged separately. Therefore, a sample will contain 5 smaller bags, each with a maximum of 10 fish. Each smaller bag is labeled to indicate from which size net the fish were taken. An outer bag is labeled to indicate the date that the sample was taken. Fishers then freeze their samples. Samples are returned to NAFC for processing. Prior to processing a sample, the catch per net for the sampling interval is summed and the percentage of the total interval catch by mesh size is calculated. A maximum of 25 fish per sample are processed based upon the proportion of the catch by mesh size. The same parameters are recorded for research gill net samples as for samples from the commercial fishery (see Commercial Sampling Protocols section in this document for further information).

Age distribution, by spawning type, and by mesh size is then calculated for each sample. This is then apportioned to the catch numbers, by net (mesh size) for the sampling interval, to provide catch-at-age, by spawning type, for the sampling interval. This is repeated for all samples from a fisher. The catch-at-age, by sample, is summed to provide catch-at-age for the contract period. Similarly, catch-at-age for all fishers within a stock area is summed to provide an annual research gill net catch-at-age (by spawning type) vector for the stock area (Fig 14 – 17).

Research gill net catch rates (catch numbers per days fished) are calculated from the total catch divided by the total nights fished for all fishers within a stock area. Catch rates at age are calculated by apportioning the total catch rate by the percentage of spring and autumn spawners and by the percentage catch-at-age, calculated above.

Research gill net catch rates at age from the spring program are provided in Tables 20 – 23 and Fig. 18 – 21). Research gill net catch rates at age from the fall program (WB-NDB and BB-TB only) are provided in Tables 24 and 25.

Catch rates from the spring research gill net program are the most important abundance index for Newfoundland east and south coast herring as they form the longest time series, are age dis-aggregated and are independent of the commercial fishery. However, there are several concerns regarding their use as an abundance index:

- Annual sample sizes are small, ranging from four fishers in FB to nine fishers in BBTB. Variability and small sample sizes diminish the chance of detecting trends unless they are substantial. This has been recognized as a concern since the inception of the program. Sample sizes were increased in 2002. There would be a substantial cost involved (gear, contracts, travel, processing of samples) to increase sample sizes further.
- Catch rates are likely confounded by systematic changes in growth and maturation rates that have occurred since their inception. It has been recommended that standardized estimates of year class and year effects be extracted from these data, using statistical models that permit the age-mesh size interaction to be quantified. This has not yet been done.
- The spring research gill net program is designed to catch spring spawning herring at a time when stock mixing (spring and autumn spawners) is minimal. However, within the last three to six years, the percentage of autumn spawners in the research gill net catch has increased substantially in all areas except FB (Fig. 22). In 2008, autumn spawners accounted for 53 % of the catch in WB-NDB, 58 % in BB-TB, and 69 % in SMB-PB. This is confounding as it is no longer clear if this is an index of spring spawners, autumn spawners, both, or none of the above. It was recommended during the 2008 RAP that consideration be given to re-instating the fall research gill net program. There would be a substantial cost involved and increased sampling time required.

Research Recommendations

1. It has already been recommended that standardized estimates of year class and year effects be extracted from these data, using statistical models that permit the age-mesh size interaction to be quantified. This has not yet been done.
2. Examine the fall research gill net catch rates (1980–91) for WB-NDB and BB-TB to determine if they can be linked with the spring catch rates (there are four years of overlapping data, from 1988 to 1991).
3. Investigate the development of a standardized catch rate series from the data series available in an effort to eliminate potential bias due to the timing in the expansion of the spring series and the effect of the changing dynamics in the autumn spawning component where the spring and fall series are combined.
4. Conduct a comparative analysis of the index of spring spawners only versus the index of spring and autumn spawners to examine for differences in trend.
5. Investigate the possibility of spawning season affinity changeover by examining growth (annulus width) over the first couple of years of life then contrasting early life growth dynamics of spring vs. autumn spawners across time.
6. Explore the possibility of calculating an index excluding periods of zero catch (when herring were not yet available in the area).

ACOUSTIC BIOMASS ESTIMATES

As part of the assessment process, DFO Science conducted 32 acoustic surveys between 1983 and 2000. From 1983 to 1986, biomass was estimated from a relationship between school area and school weight (Wheeler and Chaulk 1987). Commencing in 1987, biomass was estimated by echo integration (Table 26 and Fig. 23). Acoustic survey methodology and results have been described in previous research documents (Wheeler et al. 1999). These surveys provided empirical estimates of herring abundance by stock area independent of the commercial fishery and were also used to calibrate population abundance models.

In 2001, acoustic surveys were eliminated due to program reductions and a re-focusing of research effort in other areas. A choice had to be made between continuing acoustic surveys or continuing the research gill net program.

Acoustic surveys were expensive to operate. The lack of biological sampling was always an issue when surveys were conducted from departmental vessels (Marinus and Shamook). This was less of a problem when surveys were conducted from chartered commercial purse seine vessels. However, chartering increased the cost of the surveys. Due to concerns regarding sampling, biomass estimates could not be age dis-aggregated. This reduced their effectiveness in population abundance models.

During the late 1990s, when population levels were low, the variability of acoustic biomass estimates increased, as herring schools were smaller and less likely to be detected acoustically.

A joint Industry / Science acoustic survey was conducted in selected areas of SMB and PB in 2005 (Wheeler et al. 2006). Given that the entire stock area was not surveyed, the biomass estimate represented an un-defined proportion of the total stock biomass.

Research Recommendations

1. Acoustic surveys should be re-instated to estimate herring population sizes.
2. The historical acoustic survey data base should be used in the development of a survey design.
3. Acoustic surveys must incorporate a reliable biological sampling component as part of the survey design.
4. Surveys conducted through a joint Industry / Science initiative must ensure that the objectives of all parties are addressed.

GILL NET LOGBOOK CATCH RATES

The commercial gill net logbook program, initiated in 1996, provides a time series of standardized catch per unit effort (CPUE) data from the commercial gill net and bait fisheries. The logbook (Appendix 4) is designed to be completed voluntarily by gill net fishers in the spring commercial (food fish) fishery, spring bait (lobster) fishery, and/or fall commercial fishery. Fishers are asked to provide information regarding the number and dimensions of their gill nets, by mesh size. They are also asked to complete a logbook entry for each day that a net or nets are hauled. This entry includes the date, the number of nets hauled by mesh size, the number of nights that the nets had fished, and the approximate catch weight. Fishers are also asked questions to obtain their observations of herring abundance.

It was a conscious decision by Science to make the return of logbooks voluntary, rather than request Fisheries Management and Aquaculture Branch to make them a condition of licence. It was felt that the quality of data would be eroded if return of logbooks was made mandatory.

Each year, logbooks are sent to approximately 2200 licensed fishers and/or bait permit holders from WB to FB, including CB-SS. The return of logbooks is voluntary and the numbers returned are very low. In 2009, 37 logbooks were returned (to October 19th) and, depending upon the area fished, most returns were from winter/spring/early summer fisheries (Table 27). Logbooks from fall fisheries are even more limited in number and have not been analyzed.

In an effort to increase commercial gill net logbook return rates, reminder letters were sent to fishers in 2007 (June), in 2008 (August) and again in 2009 (June). Although results are mixed, the overall return rate has increased by 20 % from 2006 (31 logbooks) to 2009 (37 logbooks). The impact of the reminder letter is uncertain. It, in conjunction with an annual fixed gear fisher telephone survey, may have encouraged more fishers to return logbooks.

A feedback letter, including a plot of their annual catch and a logbook for the following year, is also sent to all fishers who return logbooks. As encouragement to return their logbook in the following year, a postage paid envelope is also included.

Although less than 2 % of all logbooks were returned in 2009, the percentage returned by active fishers was marginally better at 4 %, as less than half (42.5 %) of all licence and bait permit holders actively fished (Table 7).

Commercial gill net logbook catch rates are meant to compliment catch rates from the research gill net program. In 2009, the effort (net nights per fisher) represented by commercial gill net logbooks was 32 % - 40 % that of research gill net fishers in WB-NDB, BB-TB, and SMB-PB. However, in FB it was 180% and has been consistently higher through the time series (Tables 19 and 27, Fig. 24).

Catch rates from the commercial gill net logbooks (Table 27) have been standardized by panel area of nets fished. This facilitates comparison of inter-annual catch rates (kg/standard net/nights fished). Catch rates have not been standardized for mesh size. Mesh sizes tend to range from 57 – 67 mm and have not changed through the time series. Catch rates are currently age-aggregated.

It has been concluded in previous RAPs (2006 and 2008) that given inherent variability and small sample sizes, these data provide very limited information as an abundance index.

This index is inexpensive to maintain. Aside from the time to analyze the data, the only cost is postage. Further attempts should be made to increase the sample size of returned logbooks and continuing this time series. It may also be possible to add a sampling component such that age dis-aggregated catch rates could be calculated.

Research Recommendations

1. Science should actively seek fishers within each stock area to increase logbook returns.
2. Logbooks should be designed in collaboration with fishers. For example, the provision of better materials such as waterproof paper and pens would make it easier for fishers to work with the logbooks and likely result in more interest in providing the data by others.
3. Assuming adequate logbook returns, consideration should be given to adding a sampling component to provide age disaggregated catch rates.

4. Information from the logbook mail outs should be evaluated against the telephone survey when there are sufficient years of overlap, i.e., 5-7 years.

GILL NET FISHER ABUNDANCE INDEX (FROM LOGBOOKS)

This index is derived from the commercial gill net logbook program and is designed to quantify the observations of fishers on herring abundance. Fishers are asked "using a scale of 1 to 10, with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant (fish numbers) were herring in your fishing area in 2009 (the current year) compared to 2008 (the previous year)".

Observations of fishers are then included in a cumulative index similar to that calculated for Div. 4T herring (LeBlanc et al. 2007). The 1 to 10 scale of abundance, where 5.5 is the average, is converted to a scale of -4.5 to +4.5, where 0.0 is the average. A fisher's observation of abundance from year "n-1" to year "n" is recorded as a "plus" or 'minus" on this scale. An average is then derived for all fishers (by stock area); this is then added to or subtracted or subtracted from the previous year's estimate (Fig. 25).

There are concerns regarding observation-based indices. The biggest concern regards the interpretation and quantification of "average' by one fisher versus another. There are also concerns regarding how they relate to current and historical biomass levels; as such indices have an arbitrary starting point, they may not linearly tract changes in biomass. The gill net observation-based index also suffers from small sample sizes, similar to the commercial gill net catch rates.

Research Recommendations

1. Although this index provides fishers with an opportunity to express their observations of abundance, it is questionable if this index should be continued, especially if sample sizes (returned logbooks) continue to be small.

Evaluate the abundance indices between the logbooks and the telephone surveys during a suitable overlap period.

GILL NET FISHER ABUNDANCE INDEX (FROM TELEPHONE SURVEYS)

The gill net fisher telephone survey was initiated in the fall of 2006 and has been conducted annually since then. The objectives of the survey are: 1) to determine how many herring gill net licence and/or bait permit holders fished in the current year, and 2) to obtain observations of herring abundance and other information from those that did fish (Table 7).

Each year, a list of all herring gill net licence and/or bait permit holders in each of the four assessed stock areas is obtained from Policy and Economics Branch. Sample sizes are determined to provide a 10 % margin of error for all areas combined, assuming an 80 % response rate (Gower and Kelly 1993). A 10 % margin of error is deemed to be acceptable as it indicates that survey results are accurate 90 % of the time (for all areas combined). An 80 % response rate was chosen as this is comparable with telephone response rates for surveys of capelin fishers in the same areas (Brian Nakashima pers. comm.).

The names of fishers to be contacted are chosen randomly. Each fisher is telephoned a maximum of three times (at different times and on different days). If a fisher cannot be contacted after three attempts, it is considered a 'nil' response.

The 2007 phone survey questions were revised to provide enhanced information. The same questions, updated by a year, were used in 2008 and 2009 (Appendix 5).

Although catch and effort information was collected in the 2007 and 2008 phone surveys (questions 3–5), it has not yet been analyzed. In assessing observations of abundance, it was assumed that observations of all active fishers were equal, regardless of their level of effort.

Cumulative indices (Table 28 and Fig. 26), based upon responses to question 7, were calculated for the time series (2006–09), as described in the previous section.

Feed back letters and logbooks for the following year are sent out annually to all active fishers who responded to the telephone survey.

The same concern exists for this observation-based index regarding quantification of the term "average". However, this data set benefits from a large sample size, on average approximately 150 active fishers each year. Given that responses cover a broad spatial area within each stock (Figs. 27–29), it can provide a qualitative view of observed abundance within a stock area.

The telephone survey also provides an annual estimate of catches of herring used as bait. This is currently the only such estimate available.

Research Recommendations

1. Gill net logbooks and phone surveys together provide important and relevant information on the percentage of active fishers, total effort and mesh sizes, distribution of catch and effort in time and space, catches for bait and observations of abundance. In order to reliably estimate these variables information is required from at least 400 licensed fishers. It is recognized that this information could be obtained exclusively from logbooks, and if adequate sample size was achieved then this would be the preferred source. In the meanwhile it is recommended that both sources be continued and results be co-validated as soon as possible before either source is dropped.

PURSE SEINE FISHER ABUNDANCE INDEX (FROM TELEPHONE SURVEYS)

This program, initiated in 1996, provides an evaluation of biological and fishery related information from herring purse seine fishers. Each year, attempts are made to contact all active fishers by telephone after the purse seine fishery and each fisher is asked a series of standardized questions (Appendix 6).

The survey is designed to collect information from all active purse seine fishers in WB-NDB, BB-TB, and SMB-PB; there is no purse seine fishery in FB. Active fishers are determined from dock side monitoring reports. On average, over the 13 year time series, 87 % of active fishers have been interviewed (Table 10).

Feedback letters and graphs are sent annually to all active fishers who responded to the survey.

Cumulative indices were calculated, based upon purse seine fisher observations of abundance (Fig. 30). In some areas and years, this index is based upon very small sample sizes (e.g., 2000, SMB-PB, 1 fisher). Given concerns regarding observation indices and given the small sample sizes, the usefulness of this index is questionable.

The survey provides other valuable information, including annual estimates of dead discards in the purse seine fishery. It also raises questions regarding commercial landings statistics. For approximately 38 % of the records (area x year), estimated landings from the purse seine telephone survey were greater than the official reported purse seine landings (Table 10 and Fig. 31). The differences were variable and ranged from 5 % to greater than 200 %.

Consideration should be given to continuing the purse seine fisher telephone survey to estimate dead discards in the fishery, if it is decided to add dead discards to part of the catch matrix.

Research Recommendations

1. This telephone survey should be continued as, in addition to providing observations of abundance, it provides valuable information regarding discard rates and reasons for discarding.

SUMMARY OF ABUNDANCE INDICES

Seven abundance indices have been documented for east and southeast Newfoundland herring:

- spring research gill net catch rates
- fall research gill net catch rates
- acoustic biomass estimates
- gill net logbook catch rates
- gill net logbook index (from logbooks)
- gill net fisher index (from phone surveys)
- purse seine fisher index (from telephone surveys / telephone surveys)

All indices have been plotted for the entire time period of the indices (1980–2008) and for the more recent time period (1996–2008), of the current indices (Fig. 32). To compare trends, each index was standardized to its mean.

For the most recent period (2002 – 2009), indices exhibit a fair degree of coherence for WB-NDB, BB-TB and FB. For WB-NDB, most indices indicated an upward trend since 2002, levelling off or declining since 2008. For BB-TB, the upward trend peaked (for most indices) in 2007 and declined since then. For FB, most indices indicated a downward trend from the late 1990s to 2006 or 2007. Since then, observation indices show a continued downward trend whereas catch rate indices show upward movement. For SMB-PB it is not as clear as there is little coherence between indices.

MODELS TO ASSESS STOCK STATUS

Biomass was first estimated for Newfoundland east and south coast herring stocks in 1985. The following methods have been used to estimate stock biomass:

- Biomass estimates from acoustic surveys 1985–93
- Extended survivors analysis (XSA) 1994 and 1995
- Research gill net catchability analysis 1996
- Integrated catch-at-age (ICA) 1998 and 2000

Biomass estimation techniques from 1985 to 2000 have been fully described in the following research documents:

- Biomass estimates from acoustic surveys
    - Wheeler et al. 1986; Wheeler and Chaulk 1987; Wheeler et al. 1988; Wheeler et al. 1989; Wheeler et al. 1990; Wheeler et al. 1991; Wheeler et al. 1992; Wheeler et al 1994
- Extended survivors analysis
    - Wheeler et al. 1995; Wheeler and Winters 1996
- Research gill net catchability analysis
    - Wheeler et al. 1997
- Integrated catch-at-age analysis
    - Wheeler et al. 1999; Wheeler et al. 2001

Estimates of population numbers and biomass have not been available since 2001. In the assessments since then (2002, 2004. 2006, and 2008), current status and future prospects have been summarized for each stock in a performance report (Wheeler et al. 2003, 2004, 2006, 2008).

This section of the document will describe the current method used to describe stock status (performance reports) and recent attempts to model stock status using ADAPT (Gavaris 1988) and SURBA (Cook 1997).

PERFORMANCE REPORTS

Performance reports provide a qualitative assessment of current stock status and future prospects. Abundance indices and biological characteristics are interpreted and evaluated using the traffic light method (Caddy 1998). This method uses a system of red (-), yellow (?), and green (+) lights to categorize indicators as 'cause for concern', 'uncertain', or 'positive'. 'Uncertain' is defined as 'uncertainty of an interpretation' rather than precautionary uncertainty.

Five series of abundance indices are currently evaluated for each stock including:

- Research gill net catch rates (spring and autumn spawners combined) from the spring research gill net program,
- Gill net catch rates from commercial gill net logbooks,
- Gill net fisher observations from commercial gill net logbooks,
- Gill net fisher observations, from the gill net fisher telephone surveys,
- Purse seine fisher observations, from the purse seine fisher telephone surveys.

Biological characteristics, including research gill net age compositions and year class sizes are also evaluated.

Current stock status is described based upon a standardized (but arbitrary) evaluation of all abundance indices and age composition of mature age groups (Table 29). Abundance indices and age composition data are weighted based upon their perceived importance and reliability in assessing current status. Research gill net catch rates are given the most weight, followed by research gill net age compositions, and then commercial gill net catch rates, gill net fisher observations and purse seine fisher observations.

Future prospects are described by evaluating the strengths of fishery dependent year classes (year classes = n-6 and n-7) and other mature year classes (n-8, n-9, and n-10) and of the recruiting year class (n-5), as estimated from research gill net catch rates at age (Fig. 33). The strengths of fishery dependent year classes are given the most weight, followed by the strengths of other mature year classes and of the recruiting year class. Estimates of year class

strength may be biased due to systematic changes in growth due to changes in weight and presumably girth over time, the possible change in selection pattern of ages 4-6 over time, the selection of these age groups by the fishery in some years, and variable exploitation rates.

The standardized composite performance report index (Fig. 34) allows for inter-annual comparisons and provides some indication of recent stock trends. However, this index and performance reports in general do not provide any information on current stock biomass and comparisons with historical estimates. Industry and Fisheries Management Branch have found performance reports to be useful in the absence of stock biomass estimates.

Research Recommendations

1. The goal continues to be the quantitative estimation of stock biomass. In its absence, performance reports provide a useful tool to document current stock status and prospects.
2. Attempts should be made to normalize catch rates and cohort strengths to a fixed period rather than a moving target which depends on the time period being evaluated.
3. Calculate age specific recruitment potential for age 3 and 4 fish using age specific catch rates from research gill nets.

ADAPT

2008 Analysis

An analytical analysis of population size was attempted for the 2008 assessment (Wheeler et al. 2008). Initially, the thought was to use ICA as it had been used successfully in the past and would have provided direct comparisons with earlier assessments. However, this was not possible as ICA has not been updated to work with current Windows software. Its successor, FLICA, was available but requires the use of software (R) that was not available. As an alternative, ADAPT (Gavaris 1988) was available and has been used successfully for estimating herring population sizes in Div. 4T (LeBlanc et al. 2007). The outputs of this model are also familiar to most assessment scientists and provide excellent visual representation of residual patterns for abundance indices.

The combination of large mean square residuals, large relative errors of parameter estimates, and strong year and/or cohort residual patterns indicated that the model fits of the 2008 ADAPT calibrations, by stock area and spawning type, were unreliable and did not provide a true indicator of current population levels. Estimates for autumn spawners were less reliable than for spring spawners as the spring research gill net catch rates, which are the dominant indicator in the ADAPT calibrations, are designed to estimate spring spawner abundance.

2009 Analysis (Series # 1)

It was recommended during the 2008 RAP that sequential population models continue to be evaluated as a basis for estimating current and historical population sizes. It was further recommended that other models, such as ICA, FLICA, and SURBA be considered in addition to ADAPT. It was noted that better fits may be possible if all bait catches are added to the catch-at-age matrix and if acoustic estimates are used to constrain model output.

Estimates of herring bait catches and dead discards were added to the commercial catch-at-age matrices for each stock area (Tables 15 – 18).

The same data sources as in 2008 (Wheeler et al. 2008), updated by one year, were used as input to the ADAPT model for each of the four stock areas and for each spawning type and the same model assumptions were made.

The following 2009 population numbers ('000) were used:

Stock Area	Spawning Type	Age 3 (assigned)	Age 4+ (estimated)
WB-NDB	Spring	500	500
	Autumn	1500	1500
BB-TB	Spring	2500	2500
	Autumn	2500	2500
SMB-PB	Spring	300	300
	Autumn	2000	2000
FB	Spring	6000	6000
	Autumn	500	500

ADAPT calibrations were prepared by stock area and spawning type. Diagnostics (mean square residuals) are given in Table 30. For three of the four stock areas (WB-NDB, BB-TB, and FB), the mean square residual increased for both spring and autumn spawners, compared to the 2008 analysis. For BB-TB, the mean square residual decreased for autumn spawners and remained the same for spring spawners. This indicates that the precision of the model estimates decreased for three of four stock areas with the inclusion of bait estimates and dead discards. Mean square residuals remained very large, indicating that the model fits of the 2009 ADAPT calibrations, by stock area and spawning type, were unreliable and did not provide a true indicator of current population levels.

2009 Analysis (Series # 2)

A second series of ADAPT calibrations was prepared. This series examined the period from 1970 to 2000 and was run to provide a comparison with population estimates derived from ICA in the 2000 assessment (Wheeler et al. 2001). Only spring spawners were considered as ICA estimates were for spring spawners only.

The same data series (truncated to 2000) and model formulations were used. Two further calibrations were run for the period from 1970 to 2000, one with the revised catch matrix and research gill net and acoustic indices only, and the second with the old catch matrix and research gill net and acoustic indices only. The latter calibration most closely approximated the 2000 ICA calibration. Diagnostics (mean square residuals) are given in Table 31.

In the first calibration, mean square residuals decreased for WB-NDB but increased for the remaining three areas. Mean square residual patterns did not change for the latter two calibrations and remained very large overall (Table 31), indicating that ADAPT model precision would not have been sufficient to estimate population sizes in 2000.

Biomass estimates from ADAPT and ICA (Fig. 35) are compared for each of the above illustrative ADAPT calibrations (series 1 and 2). Similar historical trends (through the 1970s) are exhibited for three of the stock areas (WB-NDB, BB-TB and SMB-PB); however, the scales differ. No conclusions could be drawn for FB.

Research Recommendations

1. The calibration indices used in ADAPT should be explored for divergent trends before being introduced in the model specification to minimize unexplained residual patterns.
2. Investigate the potential effectiveness of more state of the art analytical models for assessing herring stocks.
3. Determine suitability of SPA models in general by determining probable values for M using historical consumption estimates for seals and cod and historic herring biomass estimates.

SURBA

Further to the recommendation from the 2008 RAP, analyses were conducted in 2009 using SURBA to estimate relative stock sizes.

SURBA, which stands for Survey-Based Analysis, is a separable model of mortality. It is a fishery-independent (catch free) model that can use age-based survey indices to generate relative estimates of stock sizes. The model can also accept age aggregated biomass indices. SURBA is used in ICES assessment working groups to supplement existing catch-based VPA analyses, and to provide advice for stocks where catch data are thought to be unreliable.

The following data sources were used as input to the SURBA model for each of the four stock areas; these are the same data sources used in the 2009 ADAPT calibrations:

- Weights-at-ages 3 to 11+, 1970–2008
- Spring research gill net catch rates at ages, 1982–2008
- Fall research gill net catch rates at age, 1980–91
- Acoustic biomass estimates, 1983–2000
- Gill net logbook catch rates, 1996-2008
- Gill net fisher cumulative index (from logbooks), 1996–2008
- Purse seine fisher cumulative index, 1996–2008

As this was a preliminary analysis, emphasis was placed on spring spawners, in order to compare results with ICA population estimates from the 2000 assessment (Wheeler et al. 2001). There was no one combination of parameters that provided the best results for all stocks; the following parameters were chosen to best illustrate SURBA:

	Spring Spawners			
	WBNDB	BBTB	SMBPB	FB
Reference age	6	5	6	7
Lower and upper age for mean F and Z	5-10	4–10	5–10	6–10
Lambda	1.0	1.0	1.0	1.0

SURBA does not estimate catchability coefficients (q) and assumes a default value equal to 1, meaning that estimates are absolute. In this initial analysis, the catchability coefficients of all indices were considered to be 1.

Research Recommendations

1. SURBA should be further evaluated to determine if it provides reliable relative estimates of current abundance.

2. Pre-screening of indices and evaluation of catchability coefficients prior to model formulation is highly recommended.
3. The use of observation-based indices should be further evaluated.

PRECAUTIONARY APPROACH

The concept of a precautionary approach was first applied to Newfoundland east and south coast herring stocks in 1995 (Wheeler et al. 1996). The stock status classification system linked exploitation rates to recruitment estimates at given spawning stock levels. The system used spawning stock threshold levels from an environmentally dependent recruitment relationship as its key reference point (Winters and Wheeler 1987). This was the first application of the precautionary approach to herring stocks in Atlantic Canada. The classification was used until 2001 after which spawning stock biomass estimates were no longer available.

The Department has recently developed a fishery decision-making framework incorporating the precautionary approach. The framework is based upon limit (LRP) and upper stock (USR) reference points and stock status zones. The reference points are normally based upon biomass and harvest metrics. However, for stocks that are managed on the basis of other indicators of stock condition, such as catch rate indices, the framework recommends that other metrics be considered to define serious harm and to guide decision making in relation to stock condition. Consideration should be given to what conditions, within the index, would constitute serious harm to productive potential and to define the decision-making framework in relation to those conditions. The LRP must be consistent with the point below which serious harm is occurring to the stock.

For these stocks, research gill net catch rates represent the longest and (probably) the best indicator of stock abundance. Unfortunately, the time series does not extend back to the period of high abundance in the 1970s.

Research Recommendations

1. Developing a proxy for the limit reference point should be investigated based upon research gill net catch rates.

ECOSYSTEM APPROACH TO FISHERIES

The FRCC has recommended "the implementation of an Ecosystem Approach to Fisheries (EAF) for decision making to improve fisheries management in Canada". The FRCC further recommended "that this approach be initiated in an area such as 4VWX where the existing stewardship arrangements are strong and the quality of the data available is relatively good".

At the national level, in April 2009, the Department released the Sustainable Fisheries Framework initiative and three new conservation and sustainable use policies: a policy for applying the precautionary approach in fishery decision-making, a policy on managing impacts of fisheries on sensitive benthic areas and a policy on new forage species fisheries. The Framework and policies form the foundation for taking an ecosystem approach (EA) to fisheries management and compliment regional EA approaches. The national vision for an ecosystem approach will be further articulated as more policies and tools are developed under the Sustainable Fisheries Framework.

At the regional level, the first consideration should be to estimate population levels reliably. This will provide the necessary precautionary reference points, which in turn will help determine the ecosystem impacts of the fishery.

Research Recommendations

1. Estimate populations reliably. This will provide the necessary reference points which, in turn, will help determine the ecosystem impacts of the fishery.

2009 ASSESSMENT OF STOCKS

OVERVIEW

The following changes / analyses have been conducted since the last assessment:

- Commercial catch-at-age matrices were revised in include estimates of dead discards in the purse seine fishery and estimates of herring caught for use as bait, from 1996 to 2008.
- ADAPT calibrations were run for 1970 to 2008 using the revised catch-at-age.
- ADAPT calibrations were run for 1970 to 2000 using the revised catch-at-age and the old catch-at-age.
- SURBA calibrations were run to estimate the relative biomass of spring biomass for the period from 1980 to 2008.

THE 2008 FISHERY

TACs remained unchanged from 2007 (Tables 1-6). Reported landings increased from 6600 t in 2007 to 7600 t in 2008; this represented approximately 61% of the overall TAC (Tables 1-6 and Fig. 2).

In WB-NDB, reported landings increased from 362 t in 2007 to 714 t in 2008; 42 % of the TAC was taken in 2008 (Table 1). The 2001 year class accounted for 34 % of catch numbers (including bait and discards), followed by the 2000 year class at 27% (Table 11 and Fig. 7). The age distribution was not truncated; 5 year classes (includes fish age 11+) each accounted for greater than 5 % of the catch. Autumn spawners accounted for 58 % of the catch, an increase of 3 % from 2007.

In BB-TB, reported landings remained the same in 2008 as in 2007 at 2800 t; 71 % of the TAC was taken in 2008 (Table 2). The 2001 year class accounted for 32% of catch numbers (including bait and discards), followed by the 2002 year class at 23 % (Table 12 and Fig. 8). The age distribution was not truncated; 6 year classes (includes fish age 11+) each accounted for greater than 5 % of the catch. Spring spawners accounted for 53 % of the catch, a decrease of 11 % from 2007.

In SMB-PB, reported landings increased from 759 t in 2007 to 1148 t in 2008; 50 % of the TAC was taken in 2008 (Table 4). The 2000 year class accounted for 41 % of catch numbers (including bait and discards), followed by the 2001 year class at 25 % (Table 13 and Fig. 9). The age distribution was truncated; 4 year classes (includes fish age 11+) each accounted for greater than 5 % of the catch. Autumn spawners accounted for 84% of the catch, a decrease of 5 % from 2007.

In FB, reported landings increased from 2448 t in 2007 to 2550 t in 2008; 80 % of the TAC was taken in 2008 (Table 5). Fish aged 11+ accounted for 46 % of catch numbers (including bait and discards), followed by the 2002 year class at 43 % (Table 14 and Fig. 10). The age distribution was truncated; 2 year classes (includes fish age 11 +) each accounted for greater than 5 % of the catch. Spring spawners accounted for 93 % of the catch, a decrease of 1 % from 2007.

Reported landings data are available for CB-SS and for the south coast from Cape Ray to Pass Island (Tables 3 and 6). Biological sampling data are not available for these areas. In CB-SS, 258 t was landed in 2008; this represented approximately 43% of the TAC (Table 3). Along the south coast, 103 t was landed in 2008; this represented 21% of the TAC (Table 6).

ABUNDANCE INDICES

Research Gill Net Program

In WB-NDB, catch rates of spring and autumn spawners combined decreased, but not significantly, from 233 (fish per nights fished) in 2008 to 218 in 2009 (Table 20). The 2009 catch rate was below average (Fig. 36), 57 % of the long-term mean (1988–2009). In 2008, the 2002 year class accounted for 29 % of catch numbers, followed by the 2001 year class at 19 % (Fig. 14). The age distribution was not truncated, as 5 year classes (includes fish age 11 +) each accounted for greater than 5% of the catch. Autumn spawners accounted for 53 % of the catch, an increase of 11 % from 2007.

In BB-TB, catch rates of spring and autumn spawners combined decreased, but not significantly, from 186 (fish per nights fished) in 2008 to 147 in 2009 (Table 21). The 2009 catch rate was below average (Fig. 36), 91 % of the long-term mean (1988–2009). In 2008, the 2002 year class accounted for 25 % of catch numbers, followed by the 2000 year class at 22 % (Fig. 15). The age distribution was not truncated, as 7 year classes (includes fish age 11 +) each accounted for greater than 5 % of the catch. Autumn spawners accounted for 58 % of the catch, a decrease of 2 % from 2007.

In SMB-PB, catch rates of spring and autumn spawners combined increased, but not significantly, from 65 (fish per nights fished) in 2008 to 127 in 2009 (Table 22). The 2009 catch rate was below average (Fig. 36), 74 % of the long-term mean (1988–2009). In 2008, the 2001 year class accounted for 30 % of catch numbers, followed by the 2002 year class at 27 % (Fig. 16). The age distribution was truncated, as 4 year classes (includes fish age 11+) each accounted for greater than 5 % of the catch. Autumn spawners accounted for 69 % of the catch, an increase of 2 % from 2007.

In FB, catch rates of spring and autumn spawners combined increased, but not significantly, from 338 (fish per nights fished) in 2008 to 375 in 2009 (Table 23). The 2009 catch rate was below average (Fig. 36), 60 % of the long-term mean (1988–2009). In 2008, fish aged 11 + accounted for 41 % of catch numbers, followed by the 2002 year class at 32% (Fig. 17). The age distribution was truncated, as 4 year classes (includes fish age 11 +) each accounted for greater than 5 % of the catch. Spring spawners accounted for 78 % of the catch, a decrease of 5 % from 2007.

Commercial Gill Net Logbook Program

In WB-NDB, logbook returns increased from 10 in 2008 to 12 in 2009 (Table 27). Effort (net nights per fisher) decreased by 16 % from 2008 to 2009, and was substantially lower in 2009

than for the research gill net program (Fig. 24). Catch rates (kilograms per standard net per nights fished) decreased, but not significantly, from 117.9 in 2008 to 96.4 in 2009 (Table 31). The 2009 catch rate was above average (Fig. 37), 242 % of the long-term mean (1996–2009). Fishers indicated (cumulative index) an increasing trend in abundance in the past seven years and abundance in 2009 was higher than in 2008 (Fig. 25).

In BB-TB, logbook returns increased from 5 in 2008 to 10 in 2009 (Table 27). Effort (net nights per fisher) increased by 250 % from 2008 to 2009, but was still substantially lower in 2009 than for the research gill net program (Fig. 24). Catch rates (kilograms per standard net per nights fished) increased, but not significantly, from 29.4 in 2008 to 43.7 in 2009 (Table 27). The 2009 catch rate was above average (Fig. 37), 126 % of the long-term mean (1996–2009). Fishers indicated (cumulative index) decreasing abundance in the past two years (Fig. 25).

In SMB-PB, logbook returns decreased from 7 in 2008 to 3 in 2009 (Table 27). Effort (net nights per fisher) decreased by 63 % from 2008 to 2009, and was substantially lower in 2009 than for the research gill net program (Fig. 24). Catch rates (kilograms per standard net per nights fished) increased, but not significantly, from 36.8 in 2008 to 42.7 in 2009 (Table 27). The 2009 catch rate was above average (Fig. 37), 117 % of the long-term mean (1996–2009). Fishers indicated (cumulative index) a decreasing trend in abundance in the past four years and abundance in 2009 was lower than in 2008 (Fig. 25).

In FB, logbook returns decreased from 13 in 2008 to 12 in 2009 (Table 27). Effort (net nights per fisher) increased by 12% from 2008 to 2009, and was substantially higher in 2009 than for the research gill net program (Fig. 24). Catch rates (kilograms per standard net per nights fished) decreased, but not significantly, from 49.3 in 2008 to 35.8 in 2009 (Table 27). The 2009 catch rate was slightly below average (Fig. 37), 84% of the long-term mean (1996–2009). Fishers indicated (cumulative index) a decreasing trend in abundance in the past nine years and abundance in 2009 was lower than in 2008 (Fig. 25).

Fixed Gear Fisher Telephone Survey

There were 2190 licence and/or bait permit holders within the four stock areas in 2009 (Table 7). Attempts were made to contact 414 fishers. Of these, 346 were contacted, representing an 84% response rate. Of those who were contacted, only 147 (42 %) fished in 2009. Of those who fished, a large majority (95 %) fished for bait purposes only.

In 2009, attempts were made to contact 113 fishers in WB-NDB, 12 % of all licence and bait permit holders (Table 7). The response rate was 84 %, and of the 95 fishers contacted, 37 fished in 2009, all for bait purposes. All active fishers were in NDB (Fig. 27) and observed abundance tended to be greater in the eastern part of the bay. Fishers indicated (cumulative index) an increasing trend in abundance since the survey began in 2006 and abundance in 2009 was higher than in 2008 (Fig. 26). This agreed with the cumulative index derived from gill net logbooks.

In 2009, attempts were made to contact 106 fishers in BB-TB, 19% of all licence and bait permit holders (Table 7). The response rate was 84 %, and of the 89 fishers contacted, 44 fished in 2009; of these 41 fished for bait purposes. Active fishers were distributed through BB and TB (Fig. 28); observed abundance tended to be greater in the northern part of the BB. Fishers indicated (cumulative index) little or no change in abundance over the past two years (Fig. 26). The cumulative index derived from gill net logbooks indicated a decrease in abundance over the past two years.

In 2009, attempts were made to contact 101 fishers in SMB-PB, 24 % of all licence and bait permit holders (Table 7). The response rate was 85 %, and of the 86 fishers contacted, 19 fished in 2009; of these 17 fished for bait purposes. All but one active fisher were in PB (Fig. 29); observed abundance tended to be evenly distributed throughout PB. Fishers indicated (cumulative index) an increasing trend in abundance since the survey began in 2006 and abundance in 2009 was higher than in 2008 (Fig. 26). This disagreed with the cumulative index from gill net logbooks which indicated a decreasing trend over the same period.

In 2009, attempts were made to contact 94 fishers in FB, 32% of all licence and bait permit holders (Table 7). The response rate was 81%, and of the 76 fishers contacted, 47 fished in 2009; of these 45 fished for bait purposes. Active fishers were distributed throughout the bay (Fig. 29); observed abundance tended to be inconsistent in similar locations. Fishers indicated (cumulative index) a decreasing trend in abundance since the survey began in 2006 and abundance in 2009 was lower than in 2008 (Fig. 26). This agreed with the cumulative index from gill net logbooks.

As indicated earlier, official statistics do not include landings for bait purposes for most years. Consequently, based upon results of the 2006-09 telephone surveys, landings of 95% or more of active gill net fishers are not included in annual landings data. Estimates of bait landings can be calculated for 2007–09 as estimates of catch were provided by active fishers in the telephone survey (Table 8). These estimates (averaged for 2007–09) are as follows:

	WB-NDB	BB-TB	SMB-PB	FB
Average annual estimated bait landings (t)	535	550	145	410
Bait landings estimate (t) used by FAM	500	300	150	400

Except for BB-TB, annual estimated bait landings from the telephone survey are similar to those used by Fisheries and Aquaculture Management Branch in the integrated herring management plan. The calculation of bait landings from telephone survey results provides an important method for correcting catch-at-age data, critical for analytical models of population estimation.

Purse Seine Fisher Telephone Survey

Response rates are high for most areas and years; in 2008, 25 of 28 fishers (89 %) responded to the survey (Table 10). For WB-NDB and BB-TB, where there is a fall fishery only, survey results are available to 2008. For SMB-PB, where there is a winter/spring fishery, survey results are available to 2009. There is no purse seine fishery in FB.

For WB-NDB, 7 of 7 active fishers responded to the survey in 2008. The majority fished in NDB (Fig. 31). Estimates of landings represented 131 % of reported purse seine landings in 2008 (Table 10). Fishers indicated (cumulative index) an increasing trend in abundance over the past three years and abundance in the fall of 2008 was higher than in 2007 (Fig. 30).

For BB-TB, 15 of 18 active fishers responded to the survey in 2008. The majority fished in TB (Fig. 31). Estimates of landings represented 111 % of reported purse seine landings in 2008 (Table 10). Fishers indicated (cumulative index) an increasing trend in abundance over the past five years and abundance in the fall of 2008 was higher than in 2007 (Fig. 30).

For SMB-PB, 4 of 4 active fishers responded to the survey in 2009. All fished in SMB (Fig. 31). Estimates of landings represented 113 % of reported purse seine landings in 2009 (Table 10).

Fishers indicated (cumulative index) an increasing trend in abundance over the past seven years and abundance in the spring of 2009 was higher than in 2008 (Fig. 30).

STOCK STATUS

White Bay–Notre Dame Bay

The Fishery: Reported landings increased from 362 t in 2007 to 714 t in 2008; 42 % of the TAC was taken in 2008 (Table 1). In addition to reported landings, approximately 475 t was estimated (from gill net telephone survey) to have been taken for bait purposes in 2008 (Table 8). Fishers reported approximately 3 tons of discard mortality in the 2008 fall purse seine fishery (Table 10).

Documented effort (sets per fisher) in the fall purse seine fishery decreased by 75 % from 1997 to 2008 (Table 10). Documented gill net effort (net nights fished per fisher) in the spring fishery decreased by 80% from 1996 to 2009 (Table 27).

The 2008 purse seine fishery, in November and December, was mostly in the Fogo Island area. The 2009 gill net fishery, from early May to early July, was mostly in NDB (Fig. 27).

Abundance Indices: Research gill net catch rates (number of fish per nights fished) of spring and autumn spawners combined decreased, but not significantly, from 233 in 2008 to 218 in 2009 (Table 20). The 2009 catch rate was below average, 57 % of the long-term mean (Fig. 36). Catch rates decreased significantly from 1992 to 2002.

Twelve commercial gill net logbooks were returned in 2009 (Table 27). Catch rates (kilograms per standard net per nights fished) decreased, but not significantly, from 117.9 in 2008 to 96.4 in 2009. The 2009 catch rate was above average, 242 % of the long-term mean (Fig. 37) and the second highest in the time series. Fishers indicated (cumulative index) an increasing trend in abundance in the past seven years and abundance in 2009 was higher than in 2008 (Fig. 25).

There were 37 active gill net fishers contacted in the 2009 telephone survey (Table 7). They indicated (cumulative index) an increasing trend in abundance since the survey began in 2006 and abundance in 2009 was higher than in 2008 (Fig. 26).

Seven of seven active purse seine fishers responded to the purse seine telephone survey in 2008 (Table 10). They indicated (cumulative index) an increasing trend in abundance in the past three years and abundance in the fall of 2008 was slightly higher than in 2007 (Fig. 30).

***Biological Characteristics*:** The 2002 and 2001 year classes accounted for 29 % and 19 % respectively of the 2008 research gill net catch numbers (Table 20 and Fig. 14). The age distribution was extensive as 5 year classes (including age 11+ fish) each accounted for greater than 5 % of the catch.

Based on research gill net catch rates of year classes since 1982, four of seven current mature year classes (1998-2004) are above average, and three are below average (Fig. 33). The 2004 recruiting year class is below average. The strength of the 2005 year class cannot yet be quantified. However, all year classes in this time series (with the exception of the 1982 year class) are considered to be weak in relation to the strong year classes of the late 1960's (Wheeler et al. 2001).

Current Stock Status: Biomass estimates are available to 2001 from an integrated catch-at-age analysis (Wheeler et al. 2001). A visual comparison with research gill net catch rates suggests that current abundance is substantially lower than in the 1970's (Fig. 38).

A standardized performance index is available for 1997-2009 (Fig. 34). The composite index indicates that stock status improved from 2002 to 2005, and has not changed since then.

Stock Outlook: Short term prospects are uncertain; the 2004 year class is below average but most mature year classes are above average compared to year classes since 1982 (Fig. 33). All year classes in the time series (except 1982) are weak compared to historical levels.

Bonavista Bay–Trinity Bay

The Fishery: Reported landings remained the same in 2008 as in 2007 at 2800 t; 71 % of the TAC was taken in 2008 (Table 2). In addition to reported landings, approximately 450 t was estimated (from gill net telephone survey) to have been taken for bait purposes in 2008 (Table 8). Fishers reported approximately 7 t of discard mortality in the 2008 fall purse seine fishery (Table 10).

Documented effort (sets per fisher) in the fall purse seine fishery decreased by 77 % from 2001 to 2008 (Table 10). Documented gill net effort (net nights fished per fisher) in the spring fishery decreased by 69% from 1996 to 2009 (Table 27).

The 2008 purse seine fishery, in November and December, was in the northern part of BB and in the western arms of TB. The 2009 gill net fishery, from late April to late June, was distributed widely throughout the stock area (Fig. 28).

Abundance Indices: Research gill net catch rates (number of fish per nights fished) of spring and autumn spawners combined decreased, but not significantly, from 186 in 2008 to 147 in 2009 (Table 21). The 2009 catch rate was below average, 91 % of the long-term mean (Fig. 36). Catch rates increased significantly from 2002 to 2007.

Ten commercial gill net logbooks were returned in 2009 (Table 27). Catch rates (kilograms per standard net per nights fished) increased, but not significantly, from 29.4 in 2008 to 43.7 in 2009. The 2009 catch rate was above average, 126 % of the long-term mean (Fig. 37). Fishers indicated (cumulative index) a decreasing trend in abundance in the past two years and abundance in 2009 was lower than in 2008 (Fig. 25).

There were 44 active gill net fishers contacted in the 2009 telephone survey (Table 7). They indicated (cumulative index) little or no change in abundance over the last two years (Fig. 26).

Fifteen of eighteen active purse seine fishers responded to the purse seine telephone survey in 2008 (Table 10). They indicated (cumulative index) an increasing trend in abundance in the past five years and abundance in the fall of 2008 was higher than in 2007 (Fig. 30).

Biological Characteristics: The 2002 and 2000 year classes accounted for 25 % and 22 % respectively of the 2008 research gill net catch numbers (Table 21 and Fig. 15). The age distribution was extensive as 7 year classes (including age 11+ fish) each accounted for greater than 5 % of the catch.

Based on research gill net catch rates of year classes since 1982, five of seven current mature year classes (1998-2004) are above average (Fig. 33). The 2004 recruiting year class is below average. The strength of the 2005 year class cannot yet be quantified. However, all year classes in this time series (with the exception of the 1982 year class) are considered to be weak in relation to the strong year classes of the late 1960's (Wheeler et al. 2001).

Current Stock Status: Biomass estimates are available to 2001 from an integrated catch-at-age analysis (Wheeler et al. 2001). A visual comparison with research gill net catch rates suggests that current abundance is substantially lower than in the 1970's (Fig. 38).

A standardized performance index is available for 1997-2009 (Fig. 34). The composite index indicates that stock status improved from 2002 to 2007 and has deteriorated since then.

Stock Outlook: Short term prospects are uncertain; the 2004 year class is below average but most mature year classes are above average compared to year classes since 1982 (Fig. 33). All year classes in the time series (except 1982) are weak compared to historical levels.

St. Mary's Bay–Placentia Bay

The Fishery: Reported landings increased from 759 t in 2007 to 1148 t in 2008; 50 % of the TAC was taken in 2008 (Table 4). In addition to reported landings, approximately 125 t was estimated (from gill net telephone survey) to have been taken for bait purposes in 2008 (Table 8). Fishers reported approximately 3 t of discard mortality in the 2009 spring purse seine fishery (Table 10).

Documented effort (sets per fisher) in the winter / spring purse seine fishery decreased by 68 % from 2000 to 2009 (Table 10). Documented gill net effort (net nights fished per fisher) decreased by 90 % from 1998 to 2009 (Table 27).

The 2009 purse seine fishery, in June, was on the eastern side of SMB. The 2009 gill net fishery, from early March to early June, was mostly in PB (Fig. 29).

Abundance Indices: Research gill net catch rates (number of fish per nights fished) of spring and autumn spawners combined increased, but not significantly, from 65 in 2008 to 127 in 2009 (Table 22). The 2009 catch rate was below average, 74 % of the long-term mean (Fig. 36).

Three commercial gill net logbooks were returned in 2009 (Table 27). Catch rates (kilograms per standard net per nights fished) increased, but not significantly, from 36.8 in 2008 to 42.7 in 2009. The 2009 catch rate was above average, 117 % of the long-term mean (Fig. 37) and the highest in the time series. Fishers indicated (cumulative index) a decreasing trend in abundance in the past four years and abundance in 2009 was lower than in 2008 (Fig. 25).

There were 19 active gill net fishers contacted in the 2009 telephone survey (Table 7). They indicated (cumulative index) an increasing trend in abundance since the survey began in 2006 and abundance in 2009 was higher than in 2008 (Fig. 26).

Four of four active purse seine fishers responded to the purse seine telephone survey in 2009 (Table 10). They indicated (cumulative index) an increasing trend in abundance in the past seven years and abundance in the spring of 2009 was higher than in 2008 (Fig. 30).

Biological Characteristics: The 2001 and 2002 year classes accounted for 30 % and 27 % respectively of the 2008 research gill net catch numbers (Table 22 and Fig. 16). The age

distribution was truncated as 4 year classes (including age 11 + fish) each accounted for greater than 5 % of the catch.

Based on research gill net catch rates of year classes since 1976, five of seven current mature year classes (1998-2004) are below average (Fig. 33). The 2004 recruiting year class is below average. The strength of the 2005 year class cannot yet be quantified. However, all year classes in this time series are considered to be weak in relation to the strong year classes of the late 1960's (Wheeler et al. 2001).

Current Stock Status: Biomass estimates are available to 2000 from an integrated catch-at-age analysis (Wheeler et al. 2001). A visual comparison with research gill net catch rates suggests that current abundance is substantially lower than historical estimates in the 1970's (Fig. 38).

A standardized performance index is available for 1997-2009 (Fig. 34). The composite index indicates that stock status deteriorated from 2001 to 2004 and has remained stable from 2005 to 2009.

Stock Outlook: Short term prospects are negative; the 2004 year class is below average and most mature year classes are also below average compared to year classes since 1976 (Fig. 33). All year classes in the time series are weak compared to historical levels.

Fortune Bay

The Fishery: Reported landings increased from 2448 t in 2007 to 2550 t in 2008; 80% of the TAC was taken in 2008 (Table 5). In addition to reported landings, approximately 395 t was estimated (from gill net telephone survey) to have been taken for bait purposes in 2008 (Table 8).

Documented effort in the 1980's and 1990's was very low. There is no purse seine fishery in FB. However, bar seine and trap effort, which is not measured, has increased since 1999. In 1998, combined bar seine and trap landings were 0 t. From 1999 to 2008, combined bar seine and trap landings averaged 2135 t. Documented gill net effort (net nights fished per fisher) decreased by 73 % from 1997 to 2009 (Table 27).

In recent years, most landings have been taken by bar seines and traps in the spring, primarily in the Long Harbour area. The 2009 gill net fishery, from early April to mid June, was distributed widely throughout the stock area (Fig. 29).

Abundance Indices: Research gill net catch rates (number of fish per nights fished) of spring and autumn spawners combined increased, but not significantly, from 338 in 2008 to 375 in 2009 (Table 23). The 2009 catch rate was below average, 60% of the long-term mean (Fig. 36).

Twelve commercial gill net logbooks were returned in 2009 (Table 27). Catch rates (kilograms per standard net per nights fished) decreased, but not significantly, from 49.3 in 2008 to 35.8 in 2009. The 2009 catch rate was slightly below average, 84% of the long-term mean (Fig. 37). Fishers indicated (cumulative index) a decreasing trend in abundance in the past nine years and abundance in 2009 was lower than in 2008 (Fig. 25).

There were 47 active gill net fishers contacted in the 2009 telephone survey (Table 7). They indicated (cumulative index) a decreasing trend in abundance since the survey began in 2006 and abundance in 2009 was lower than in 2008 (Fig. 276.

Biological Characteristics: Fish age 11+ and the 2002 year class accounted for 41 % and 32 % respectively of the 2008 research gill net catch numbers (Table 23 and Fig. 17). The age distribution was truncated as 4 year classes (including age 11+ fish) each accounted for greater than 5 % of the catch.

Based on research gill net catch rates of year classes since 1976, three of seven current mature year classes (1998-2004) are below average, two are average and two are above average (Fig. 33). The 2004 recruiting year class is below average. The strength of the 2005 year class cannot yet be quantified.

Current Stock Status: Biomass estimates are available to 2001 from a research gill net catchability analysis (Wheeler et al. 2001). A visual comparison with research gill net catch rates suggests that current abundance is substantially lower than peak estimates in the late 1990's (Fig. 38).

A standardized performance index is available for 1997-2009 (Fig. 34). The composite index indicates that stock status deteriorated from 2001 to 2006 but has remained stable from 2006 to 2009.

Stock Outlook: Short term prospects are negative; the 2004 year class is below average but most mature year classes are average or below average compared to year classes since 1976 (Fig. 33).

PERFORMANCE REPORT TABLES

Current status and outlook for each stock is summarized in a performance report table (Tables 32–36).

SOURCES OF UNCERTAINTY

The major uncertainty in this assessment continues to be the inability to estimate current stock sizes and exploitation rates, and to place these estimates within an historical context. Models which depend upon catch-at-age are difficult to calibrate due to low catch levels in some areas and years. Such models are further complicated due to uncertainties in the catch-at-age. Estimates of dead discards in the purse seine fishery (1996–2008) and estimates of herring caught for use as bait (1996–2008) were added to the catch-at-age matrices this year. However, population sizes still could not be accurately estimated using ADAPT.

The evaluation of trends within abundance indices is dependent, among other things, upon the uncertainties associated with each index. Due to the limited fishery and research data, sample sizes for most indices in these assessments, with the exception of the gill net fisher index from telephone surveys, are generally small resulting in higher uncertainties. This becomes particularly evident in their resulting residual patterns in ADAPT calibrations.

There continues to be concerns regarding how to quantify the observations of abundance of gill net and purse seine fishers in estimating current abundance.

Estimation of recruiting year class strength is important in evaluating the future prospects of these stocks. Recruitment data are available from the research gill net data set, and may be biased by systematic changes in growth. Strong year classes are normally seen across stock

areas and quickly become dominant in most data sources. However, it is more difficult to predict the future prospects of weak and moderately strong year classes.

Standardization of performance reports requires the combination of several indices. In this assessment, as in the past, indices were weighted subjectively based upon the perceived degree to which each data source provides an index of abundance.

The inability to estimate population sizes has precluded the calculation of stock status zones and reference points. This severely limits the implementation of the precautionary approach in fisheries management decisions.

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Table 1. White Bay (WB)–Notre Dame Bay (NDB) herring landings and TAC's (t), by gear, 1996–2009. Landings are from Policy and Economics Branch and do not include herring discards or herring used as bait.

Year	Area	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1996	WB	184	0	-	1	0	185	
	NDB	252	0	-	229	0	481	
	Combined	435	0	-	230	0	665	1600
1997	WB	11	0	-	10	57	78	
	NDB	2364	0	-	11	7	2382	
	Combined	2375	0	-	21	64	2460	4900
1998	WB	106	0	-	6	27	139	
	NDB	484	7	-	30	1	522	
	Combined	606	7	-	36	28	661	2500
1999	WB	0	0	-	4	30	34	
	NDB	931	0	-	53	0	984	
	Combined	931	0	-	57	30	1018	2500
2000	WB	74	0	-	3	2	79	
	NDB	997	0	-	16	1	1014	
	Combined	1071	0	-	19	3	1093	2500
2001	WB	13	0	-	7	5	25	
	NDB	0	0	-	0	1	1	
	Combined	13	0	-	7	6	26	1100
2002	WB	0	13	-	6	5	23	
	NDB	303	0	-	7	23	333	
	Combined	300	13	-	13	28	357	1100
2003	WB	0	0	-	22	0	22	
	NDB	195	87	-	24	4	310	
	Combined	195	87	-	46	4	332	1100
2004	WB	11	2	-	4	28	45	
	NDB	152	48	-	8	13	220	
	Combined	163	50	-	12	40	265	1100
2005	WB	39	174	115	2	174	505	
	NDB	97	259	2	10	17	386	
	Combined	136	433	117	12	190	891	1100
2006	WB	56	16	21	8	49	150	
	NDB	83	58	0	19	0	159	
	Combined	139	74	21	27	49	309	1100
2007*	WB	13	8	0	0	9	31	
	NDB	320	7	0	0	4	331	
	Combined	333	15	0	0	13	362	1700
2008*	WB	211	0	3	0	2	216	
	NDB	228	246	19	4	1	498	
	Combined	439	246	22	4	3	714	1700
2009*	WB	1	0	0	0	0	1	
	NDB	0	0	0	1	0	1	
	Combined	0	0	0	1	0	2	2200

* provisional

Table 2. Bonavista Bay (BB)–Trinity Bay (TB) herring landings and TAC's (t), by gear, 1996–2009. Landings are from Policy and Economics Branch and do not include herring discards or herring used as bait.

Year	Area	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1996	BB	345	0	-	300	1	645	
	TB	13	13	-	78	0	410	
	Combined	358	13	-	378	1	1054	1400
1997	BB	321	0	-	72	1	394	
	TB	329	211	-	129	41	710	
	Combined	650	211	-	201	42	1104	1600
1998	BB	352	62	-	148	0	562	
	TB	356	10	-	22	22	410	
	Combined	708	72	-	170	22	972	2500
1999	BB	563	222	-	94	0	879	
	TB	245	208	-	100	0	553	
	Combined	808	430	-	194	0	1432	2500
2000	BB	493	195	-	135	8	831	
	TB	2	190	-	67	0	259	
	Combined	495	385	-	202	0	1090	2500
2001	BB	241	16	-	37	0	294	
	TB	18	155	-	19	0	192	
	Combined	259	171	-	56	0	486	3500
2002	BB	0	297	-	25	7	329	
	TB	200	4	-	13	20	237	
	Combined	200	301	-	38	27	566	3500
2003	BB	343	1	-	48	90	482	
	TB	0	0	-	8	0	8	
	Combined	343		-	56	90	490	3000
2004	BB	188	139	-	3	2	322	
	TB	134	19	-	21	2	177	
	Combined	322	158	-	24	5	509	3000
2005	BB	910	456	21	154	82	1623	
	TB	604	103	142	163	5	1017	
	Combined	1515	559	162	317	87	2640	3000
2006	BB	703	467	63	33	4	1270	
	TB	340	129	62	103	0	636	
	Combined	1043	596	125	136	4	1906	3000
2007*	BB	465	381	301	22	0	1169	
	TB	784	197	473	132	23	1608	
	Combined	1249	578	774	154	23	2777	4000
2008*	BB	1138	197	405	10	0	1750	
	TB	777	21	221	34	0	1079	
	Combined	1915	218	626	44	0	2829	4000
2009*	BB	0	37	720	125	0	882	
	TB	5	226	122	21	0	374	
	Combined	5	263	842	146	0	1256	4500

* provisional

Table 3. Conception Bay (CB)–Southern Shore (SS) herring landings and TAC's (t), by gear, 1996–2009. Landings are from Policy and Economics Branch and do not include herring discards or herring used as bait.

Year	Area	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1996	CB	80	0	-	3	0	83	
	SS	0	0	-	1	0	1	
	Combined	80	0	-	4	0	84	500
1997	CB	177	0	-	0	0	177	
	SS	0	0	-	0	0	0	
	Combined	177	0	-	0	0	177	600
1998	CB	32	0	-	5	2	40	
	SS	0	0	-	0	0	0	
	Combined	32	0	-	5	2	40	600
1999	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2000	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2001	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2002	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2003	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2004	CB	0	0	-	0	0	0	
	SS	0	0	-	0	0	0	
	Combined	0	0	-	0	0	0	600
2005	CB	1	3	0	3	1	8	
	SS	0	0	0	0	3	3	
	Combined	1	3	0	3	4	11	600
2006	CB	0	0	0	7	0	7	
	SS	0	0	0	0	0	0	
	Combined	0	0	0	7	0	7	600
2007*	CB	94	0	0	0	0	94	
	SS	0	0	0	0	0	0	
	Combined	94	0	0	0	0	94	600
2008*	CB	258	0	0	0	0	258	
	SS	0	0	0	0	0	0	
	Combined	258	0	0	0	0	258	600
2009*	CB	0	0	0	0	0	0	
	SS	0	0	0	0	0	0	
	Combined	0	0	0	0	0	0	600

- Provisional

Table 4. St. Mary's Bay (SMB)–Placentia Bay (PB) herring landings and TAC's (t), by gear, 1996–2009. Landings are from Policy and Economics Branch and do not include herring discards or herring used as bait.

Year	Area	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1996	SMB	217	0	-	1	0	217	
	PB	229	15	-	37	0	282	
	Combined	446	15	-	38	0	499	700
1997	SMB	1650	0	-	1	0	1651	
	PB	2186	100	-	20	0	2306	
	Combined	3836	100	-	21	0	3957	6600
1998	SMB	707	0	-	14	0	721	
	PB	1574	0	-	4	0	1578	
	Combined	2281	0	-	18	0	2299	2000
1999	SMB	0	0	-	0	0	0	
	PB	330	0	-	1	0	331	
	Combined	330	0	-	1	0	331	2000
2000	SMB	0	0	-	0	0	0	
	PB	447	41	-	4	0	492	
	Combined	447	41	-	4	0	492	2000
2001	SMB	57	0	-	0	0	57	
	PB	394	213	-	38	0	645	
	Combined	451	213	-	38	0	702	2000
2002	SMB	100	0	-	0	0	100	
	PB	1297	0	-	135	36	1468	
	Combined	1398	0	-	135	36	1568	2000
2003	SMB	0	0	-	11	0	11	
	PB	925	19	-	74	0	1018	
	Combined	925	19	-	84	0	1029	2500
2004	SMB	342	0	-	79	0	421	
	PB	897	71	-	1	0	968	
	Combined	1240	71	-	179	0	1389	2500
2005	SMB	1101	43	0	0	2	1146	
	PB	146	0	0	134	0	280	
	Combined	1247	43	0	134	2	1426	2500
2006	SMB	729	0	0	0	0	729	
	PB	649	0	0	150	0	799	
	Combined	1378	0	0	150	0	1528	2500
2007*	SMB	528	0	34	0	0	562	
	PB	30	0	0	167	0	197	
	Combined	558	0	34	167	0	759	2500
2008*	SMB	236	0	0	0	0	236	
	PB	831	0	0	79	2	912	
	Combined	1067	0	0	79	2	1148	2500
2009*	SMB	700	0	0	0	0	700	
	PB	0	0	0	101	0	101	
	Combined	700	0	0	101	0	801	2250

* provisional

Table 5. Fortune Bay (FB) herring landings and TAC's (t), by gear, 1996–2009. Landings are from Policy and Economics Branch and do not include herring discards or herring used as bait.

Year	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1996	0	35	-	31	4	70	1500
1997	0	92	-	28	23	143	5400
1998	0	0	-	0	0	0	5400
1999	0	337	-	30	88	455	5400
2000	0	791	-	16	35	842	5400
2001	0	1592	-	0	190	1782	2700
2002	0	1895	-	0	364	2259	2700
2003	0	2427	-	0	880	3307	3700
2004	0	1655	-	54	1221	2930	3700
2005	0	2084	0	4	564	2652	3700
2006	0	2027	0	4	310	2341	3700
2007*	0	1987	0	2	459	2448	3200
2008*	29	1760	133	2	626	2550	3200
2009*	0	1857	0	6	498	2361	2880

* provisional

Table 6. South coast Newfoundland (Cape Ray to Pass Island) herring landings and TAC's (t) (Cinq Cerf Bay to Pass Island), by gear, 1998–2009. Landings are from Policy and Economics Branch and do not include herring discards or herring used as bait.

Year	Purse Seine	Bar Seine	Tuck Seine	Gill Net	Trap	Total	TAC
1998	178	0	-	67	0	245	350
1999	1161	0	-	43	0	1205	350
2000	77	0	-	108	12	197	350
2001	843	0	-	127	66	1036	350
2002	261	28	-	170	50	510	350
2003	102	108	-	172	102	485	500
2004	0	0	-	29	213	243	500
2005	0	0	0	102	152	254	500
2006	111	0	0	91	187	389	500
2007*	0	0	0	53	116	169	500
2008*	0	0	0	9	94	103	500
2009*	0	0	0	20	17	37	500

* provisional

Table 7. Results of the telephone phone survey of herring commercial gill net licence and/or bait permit holders, by stock area and year (2006-09).

Stock Area	Year	Licences and Bait Permits		Fishers Phoned		Fishers Contacted		Active Fishers		Fished for Bait		Fished Commercially		Mean Fisher Age
		#	% of total	#	% within	#	% within	#	% within	#	% within	#	% within	
WBNDB	2006	989	42.5	113	11.4	84	74.3	40	47.6	39	97.5	1	2.5	52
	2007	969	42.5	113	11.7	103	91.2	42	40.8	42	100.0	0	0.0	50
	2008	959	42.3	113	11.8	92	81.4	32	34.8	32	100.0	0	0.0	52
	2009	930	42.5	113	12.2	95	84.1	37	38.9	37	100.0	0	0.0	55
BBTB	2006	577	24.8	106	18.4	88	83.0	49	55.7	44	89.8	5	10.2	49
	2007	562	24.6	106	18.9	88	83.0	50	56.8	44	88.0	6	12.0	50
	2008	560	24.7	106	18.9	92	86.8	43	46.7	41	95.3	2	4.7	52
	2009	547	25.0	106	19.4	89	84.0	44	49.4	41	93.2	3	6.8	53
SMBPB	2006	453	19.5	103	22.7	79	76.7	22	27.8	21	95.5	1	4.5	54
	2007	445	19.5	102	22.9	83	81.4	19	22.9	17	89.5	2	10.5	57
	2008	444	19.6	102	23.0	78	76.5	17	21.8	17	100.0	0	0.0	54
	2009	415	18.9	101	24.3	86	85.1	19	22.1	17	89.5	2	10.5	56
FB	2006	307	13.2	95	30.9	79	83.2	57	72.2	55	96.5	2	3.5	51
	2007	304	13.3	94	30.9	81	86.2	52	64.2	51	98.1	1	1.9	49
	2008	304	13.4	94	30.9	84	89.4	50	59.5	50	100.0	0	0.0	51
	2009	298	13.6	94	31.5	76	80.9	47	61.8	45	95.7	2	4.3	53
Combined	2006	2326	100.0	417	17.9	330	79.1	168	50.9	159	94.6	9	5.4	52
	2007	2280	100.0	415	18.2	355	85.5	163	45.9	154	94.5	9	5.5	52
	2008	2267	100.0	415	18.3	346	83.4	142	41.0	140	98.6	2	1.4	52
	2009	2190	100.0	414	18.9	346	83.6	147	42.5	140	95.2	7	4.8	54

Table 8. Estimation of herring used for bait, by stock area; data from the 2007-09 gill net fisher phone surveys.

2007	WBNDB	BBTB	SMBPB	FB
Number of licences and bait permits	969	562	445	304
Percentage active fishers from 2007 phone survey	40.8	56.8	22.9	64.2
Estimated number of active fishers by stock area	395	319	102	195
Number of active bait fishers from 2007 phone survey	42	44	17	51
Total bait fisher landings (lbs) from survey	170220	196748	63599	293401
Total bait fisher landings (kg) from survey	77212	89245	28849	133087
Landings per bait fisher (kg)	1838	2028	1697	2610
Estimated bait landings (t) by stock area	727	647	173	509
Bait landings estimate (t) used by Fisheries Management	500	300	150	400

2008	WBNDB	BBTB	SMBPB	FB
Number of licences and bait permits	959	560	444	304
Percentage active fishers from 2008 phone survey	34.8	46.7	21.8	59.5
Estimated number of active fishers by stock area	334	262	97	181
Number of active bait fishers from 2008 phone survey	32	41	17	50
Total bait fisher landings (lbs) from survey	100210	155955	49290	240690
Total bait fisher landings (kg) from survey	45455	70741	22358	109177
Landings per bait fisher (kg)	1420	1725	1315	2184
Estimated bait landings (t) by stock area	474	451	127	395
Bait landings estimate (t) used by Fisheries Management	500	300	150	400

2009	WBNDB	BBTB	SMBPB	FB
Number of licences and bait permits	930	547	415	298
Percentage active fishers from 2009 phone survey	38.9	49.4	22.1	61.8
Estimated number of active fishers by stock area	362	270	92	184
Number of active bait fishers from 2009 phone survey	37	41	17	45
Total bait fisher catches (lbs) from survey	91950	183120	56250	169500
Total bait fisher catches (kg) from survey	41709	83063	25515	76885
catches per bait fisher (kg)	1127	2026	1501	1709
Estimated bait catches (t) by stock area	408	547	138	315
Bait estimate (t) used by Fisheries Management	500	300	150	400

*Table 9. Estimation of herring used as bait, by stock area, 1998–2009. * A fisher is considered active if he/she participates in the annual lobster fishery and landings are recorded against his/her FIN. ** Bait per fisher, 1998–2006, was estimated from the 2007 and 2008 gill net fisher telephone surveys. *** Estimates for 2007–09 were taken directly from annual gill net fisher telephone surveys.*

Stock Area	Year	Active Fishers *	Bait (t) per Fisher **	Pots per Fisher	Total Bait (t)
WB-NDB	1998	882	1.629	200	1437
	1999	667	1.629	200	1087
	2000	615	1.629	200	1002
	2001	593	1.629	200	966
	2002	574	1.629	200	935
	2003	533	1.629	200	868
	2004	488	1.629	200	795
	2005	521	1.629	200	849
	2006	485	1.629	200	790
	2007***				727
	2008***				474
	2009***				408
BB-TB	1998	405	1.877	200	760
	1999	388	1.877	200	728
	2000	365	1.877	200	685
	2001	338	1.877	200	634
	2002	309	1.877	200	580
	2003	301	1.877	200	565
	2004	271	1.877	200	509
	2005	296	1.877	200	555
	2006	278	1.877	200	522
	2007***				647
	2008***				451
	2009***				547
SMB-PB	1998	342	2.259	300	773
	1999	296	2.259	300	669
	2000	246	2.259	300	556
	2001	280	2.259	300	633
	2002	231	2.259	300	522
	2003	231	1.506	200	348
	2004	189	1.506	200	285
	2005	210	1.506	200	316
	2006	189	1.506	200	285
	2007***				173
	2008***				127
	2009***				138
FB	1998	215	2.397	200	516
	1999	189	2.397	200	452
	2000	190	2.397	200	456
	2001	183	2.397	200	438
	2002	184	2.397	200	442
	2003	188	2.397	200	451
	2004	189	2.397	200	452
	2005	190	2.397	200	455
	2006	192	2.397	200	459
	2007***				509
	2008***				395
	2009***				315

Table 10. Parameters, landings data, discard data, effort, and abundance indices, by stock area and year, from commercial purse seine telephone surveys.

Stock Area	Year	Number who Fished	Number to Respond	Mean Fisher Age	Total Estimate of Landings (t)	Total Comm. Landings (t)	Total Estimate of Discards (t)	Estimate of Discard Survival (%)	Total Estimate of Removals (t)	Removal to Landing Ratio	Effort (sets per fisher)	Current Year Abundance Index	Cumulative Abundance Index
WBNDB	1996	18	17	43	392	435	446	49	620	1.58	1.5	7.88	1.33
	1997	15	14	49	1801	2375	2045	97	1866	1.04	21.0	6.92	0.83
	1998	6	6	46	302	606	540	93	338	1.12	18.0	6.75	0.58
	1999	7	7	52	882	931	116	39	953	1.08	10.0	8.50	6.08
	2000	12	9	50	651	1071	130	100	651	1.00	2.4	5.88	6.08
	2001	0	0	-	-	13	-	-	-	-	-	-	-
	2002	3	3	51	260	300	25	93	262	1.01	4.0	8.67	8.41
	2003	4	4	53	201	195	193	40	317	1.58	2.0	9.00	8.41
	2004	5	4	51	109	163	13	0	121	1.11	1.0	8.25	8.41
	2005	4	4	48	84	136	12	35	92	1.10	1.0	9.00	8.08
	2006	6	4	49	160	139	15	10	174	1.09	1.0	8.00	11.33
	2007	2	2	50	325	333	0	-	325	1.00	4.3	6.50	11.83
	2008	7	7	42	575	439	25	90	577.5	1.00	5.3	8.07	14.58
	2009												
BBTB	1996	21	21	46	738	358	209	50	842	1.14	4.4	8.62	1.12
	1997	16	15	45	736	650	47	60	755	1.03	9.1	6.93	0.74
	1998	13	11	48	621	708	9	50	625	1.01	10.1	7.55	0.11
	1999	14	14	47	894	808	219	69	962	1.08	8.8	5.79	-1.64
	2000	7	5	50	344	495	264	95	358	1.04	14.6	5.00	-3.44
	2001	5	4	54	260	259	2030	83	615	2.37	31.5	7.75	-3.94
	2002	5	4	55	200	200	225	100	200	1.00	3.8	6.75	-3.94
	2003	2	2	55	378	343	25	20	398	1.05	17.0	6.00	-3.94
	2004	4	1	49	100	322	0	-	100	1.00	8.0	8.00	-1.94
	2005	10	7	50	1315	1515	59	30	1356	1.03	8.4	9.29	-0.19
	2006	12	10	47	1100	1043	765	86	1209	1.10	7.4	8.60	2.71
	2007	18	15	47	1474	1249	0	-	1474	1.00	5.5	8.30	5.79
	2008	18	15	51	2077	1915	25	70	2084	1.00	7.3	7.5	8.25
	2009												
SMBPB	1996	10	9	47	460	446	225	50	572	1.24	1.8	8.67	0.50
	1997	15	15	48	4401	3836	403	82	4474	1.02	21.1	8.19	0.50
	1998	15	13	47	1727	2281	790	99	1736	1.01	10.8	2.60	-4.94
	1999	3	2	47	186	330	0	-	186	1.00	13.0	5.00	-5.94
	2000	1	1	57	400	447	105	90	411	1.03	24.0	5.00	-2.94
	2001	2	2	59	430	451	100	95	435	1.01	5.5	7.67	-2.64
	2002	8	8	49	1440	1398	1050	98	1458	1.01	6.9	9.13	-2.64
	2003	9	4	50	467	925	165	98	471	1.01	7.5	6.00	-1.64
	2004	11	10	51	1272	1240	2	100	1272	1.00	8.7	8.38	-0.93
	2005	14	9	52	975	1247	572	98	984	1.01	8.1	8.67	-0.26
	2006	9	7	48	1005	1378	58	100	1005	1.00	6.7	8.29	0.24
	2007	3	3	39	601	558	25	65	610	1.01	10.0	8.33	2.24
	2008	6	4	59	1044	1067	50	95	1046	1.00	8.0	8.75	5.99
	2009	4	4	50	790	700	11	75	793	1.00	7.8	8.00	6.74

Table 11. Catch-at-age of spring and autumn spawning herring for White Bay–Notre Dame Bay, 1970–2008; includes 1996–2008 estimates of herring discards in the purse seine fishery and 1996–2008 estimates of herring caught for use as lobster bait.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	10	1	5	1	1	2	56	50	1	1	115	445	76
3	1	129	290	727	4	128	24	1671	55	60	46	152	371
4	12	88	2396	1411	123	215	506	107	2034	50	1240	41	332
5	24	161	353	2825	3142	453	237	468	317	2928	92	1231	59
6	24	64	69	761	5446	5438	868	184	1034	323	1080	63	268
7	972	425	122	719	1193	7069	10893	793	517	1410	17	805	34
8	11	10184	403	654	697	1123	17145	7363	2509	767	496	64	258
9	83	233	1363	416	1506	838	1328	12675	10807	2222	179	344	19
10	159	254	205	1685	858	810	3364	1055	11756	14413	1450	194	192
11+	275	3105	808	794	2378	3999	8535	15707	14379	27508	14653	10908	4059
Total	1572	14645	6015	9994	15349	20076	42957	40074	43410	49683	19369	14248	5669

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	1	1	1	195	26	3113	1	1	2273	1	1	1	1
2	1	6	3	29	1105	407	23	1	29	940	1	1	1
3	38	12	187	975	324	1044	128	1936	386	207	96	1	96
4	46	124	350	2945	7201	291	613	285	16183	942	31	1054	609
5	23	1218	240	308	25843	2984	124	637	1542	8940	263	121	2747
6	14	73	1486	667	1651	11819	3106	240	553	483	3614	1674	129
7	93	114	108	1258	1067	1036	10566	2451	103	371	75	2199	701
8	1	157	275	198	2088	1137	370	7360	2145	211	199	108	1513
9	26	37	94	162	399	1454	1081	532	4432	722	70	192	183
10	4	122	81	179	442	315	844	1132	537	2796	544	49	127
11+	805	1938	2110	1973	4566	2943	2178	1148	2201	3509	861	441	337
Total	1052	3802	4935	8889	44712	26543	19034	15723	30384	19122	5755	5841	6444

Age	1996*	1997*	1998*	1999*	2000*	2001*	2002*	2003*	2004*	2005*	2006*	2007**	2008**
1	1	1	1	1	1	1	1	1	1	83	1	1	1
2	252	106	1	1	1	121	1	1	510	90	1	1	15
3	0	3337	885	81	404	713	516	517	1045	1063	40	3	253
4	5	106	1128	1838	175	2127	298	5350	1794	1685	953	349	37
5	1559	65	23	2272	3811	120	90	142	2956	819	513	1058	240
6	3008	3558	17	1	3103	2716	266	226	0	2465	302	563	582
7	163	3161	1304	95	96	1	315	1	22	169	348	30	826
8	727	54	3440	1465	0	1	29	1	1	5	1	92	81
9	1215	217	237	2021	151	1	1	1	1	1	1	1	1
10	1	687	160	95	28	1	1	1	1	89	47	27	22
11+	599	2116	1354	285	55	1	376	1	4	10	1	1	1
Total	7530	13406	8550	8154	7825	5804	1894	6242	6334	6478	2207	2126	2059

* includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait.

** includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait; catch data preliminary.

Table 11 (Cont'd.)

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	53	1	1	6	1	1	1	1	71	1	72
4	1	1	17	7	11	64	31	45	6	1	13	13	26
5	26	6	74	22	124	3	35	35	24	10	13	86	62
6	10	14	79	25	10	25	51	85	155	267	23	11	16
7	39	11	67	60	48	16	20	54	171	172	272	1	12
8	60	26	0	25	2	21	40	1	24	160	4	100	9
9	20	17	164	13	46	3	46	94	2	133	19	1	42
10	11	19	81	97	7	2	4	1	130	1	1	4	1
11+	172	291	562	298	346	302	329	182	238	298	450	65	23
Total	342	388	1099	550	597	444	559	500	753	1045	868	284	265

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	11
3	1	1	1	10	2	1	1	1	1	1	1	1	1
4	74	60	29	67	297	92	65	130	188	109	1	7	11
5	25	409	94	69	469	115	12	65	450	187	48	70	37
6	23	66	333	79	156	45	5	52	98	172	78	80	2
7	1	30	137	373	112	20	574	84	36	48	113	137	120
8	1	8	32	68	630	7	70	37	128	46	79	25	3
9	6	7	23	6	152	560	1	1	249	80	42	4	24
10	1	3	10	1	10	6	533	4	120	19	21	1	1
11+	1	24	74	42	108	306	29	577	2733	613	349	14	204
Total	135	610	735	717	1938	1154	1292	953	4005	1277	734	341	415

Age	1996*	1997*	1998*	1999*	2000*	2001*	2002*	2003*	2004*	2005*	2006*	2007**	2008**
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	9	1	1	1
3	30	1	1	1	28	7	1	1	40	3	1	1	95
4	0	163	117	203	176	118	194	255	289	331	47	55	130
5	0	284	28	122	613	0	149	611	40	1635	852	178	179
6	1083	21	1	162	263	119	720	36	134	130	1991	1224	359
7	16	243	1	41	139	1	1021	142	16	14	202	914	868
8	142	1	128	1	96	1	262	36	12	5	1	130	1232
9	142	72	23	1	28	1	59	36	1	37	6	1	1
10	142	1	1	1	1	1	61	1	1	8	6	1	1
11+	1	36	1	122	28	1	407	1	1	5	47	130	1
Total	1558	824	303	655	1373	251	2875	1121	535	2177	3154	2637	2866

* includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait.

** includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait; catch data preliminary.

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Total	1914	15033	7114	10544	15946	20520	43516	40574	44163	50728	20237	14532	5934
% SS	82.1	97.4	84.6	94.8	96.3	97.8	98.7	98.8	98.3	97.9	95.7	98.0	95.5
% AS	17.9	2.6	15.4	5.2	3.7	2.2	1.3	1.2	1.7	2.1	4.3	2.0	4.5

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total	1187	4412	5670	9606	46650	27697	20326	16676	34389	20399	6489	6182	6859
% SS	88.6	86.2	87.0	92.5	95.8	95.8	93.6	94.3	88.4	93.7	88.7	94.5	94.0
% AS	11.4	13.8	13.0	7.5	4.2	4.2	6.4	5.7	11.6	6.3	11.3	5.5	6.0

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	9087	14231	8853	8809	9198	6055	4769	7363	6869	8655	5361	4763	4925
% SS	82.9	94.2	96.6	92.6	85.1	95.9	39.7	84.8	92.2	74.8	41.2	44.6	41.8
% AS	17.1	5.8	3.4	7.4	14.9	4.1	60.3	15.2	7.8	25.2	58.8	55.4	58.2

Table 12. Catch-at-age of spring and autumn spawning herring for Bonavista Bay-Trinity Bay, 1970–2008; includes 1996–2008 estimates of herring discards in the purse seine fishery and 1996–2008 estimates of herring caught for use as lobster bait.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	1	1	1	1	1	1	5	10	1	1	1	1	1
2	1	1	1	1	1	1	14	16	22	6	15	136	1
3	1	690	10	1	1	392	77	248	26	286	13	246	8
4	1	311	1347	60	2	134	493	135	357	167	195	53	11
5	9	102	389	4887	235	163	123	759	122	765	43	256	2
6	55	64	91	126	4795	2564	166	227	251	19	293	26	30
7	808	361	75	96	424	14330	4897	50	112	436	52	288	5
8	35	1373	88	0	151	455	20697	6209	598	101	264	23	35
9	126	151	480	48	294	995	909	23206	4412	530	75	321	5
10	69	126	14	271	69	727	854	774	13394	5575	967	88	65
11+	212	522	213	1	1849	1679	4306	5890	5956	19994	12259	11762	1186
Total	1318	3702	2709	5492	7822	21441	32541	37524	25251	27880	14177	13200	1349

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	1	1	1	151	296	717	1	1	115	1	1	1	4
2	1	4	13	207	1352	6612	563	58	689	499	354	1	1
3	4	22	175	443	413	9910	1043	3094	210	1056	621	394	107
4	34	35	70	4445	2845	267	3323	422	13551	271	160	819	2645
5	7	210	87	261	16208	3674	264	2350	2586	12612	344	303	349
6	2	9	351	161	334	21739	1428	94	3859	2422	3779	1072	64
7	15	5	37	262	359	782	8639	629	347	579	422	3878	152
8	1	12	27	38	126	713	13	4439	1550	194	385	479	978
9	8	2	13	10	33	8	216	235	7505	1394	132	471	172
10	2	2	22	31	6	55	100	325	447	2054	657	530	163
11+	159	154	797	657	956	1247	508	466	891	653	1092	2614	649
Total	234	456	1593	6666	22928	45724	16098	12113	31750	21735	7947	10562	5284

Age	1996*	1997*	1998*	1999*	2000*	2001*	2002*	2003*	2004*	2005*	2006*	2007**	2008**
1	1	0	1	1	51	1	1	1	1	1	1	1	1
2	1	79	58	50	367	446	1	1	260	47	1	1	88
3	31	310	538	48	212	531	596	401	406	3159	365	37	385
4	71	14	511	889	223	406	412	2403	237	2337	3003	530	359
5	5181	98	94	701	909	64	250	267	848	678	489	2502	504
6	766	6169	136	11	663	129	138	121	247	3209	315	2050	2430
7	115	616	3826	14	49	397	157	1	99	352	1686	559	1658
8	162	7	272	3576	23	115	160	1	172	76	182	2145	573
9	518	1	4	1251	2259	1	2	1	118	63	48	256	234
10	11	101	4	63	112	5	1	1	8	87	1	93	193
11+	432	95	146	108	539	453	1149	7	45	139	318	204	325
Total	7288	7488	5590	6711	5407	2548	2867	3205	2442	10148	6408	8377	6752

* includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait.

** includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait; catch data preliminary.

Table 12 (Cont'd.)

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	10	1	1	1	14	6	3
4	1	1	1	1	1	26	22	55	16	1	11	115	1
5	1	10	1	1	1	30	77	16	14	27	17	106	8
6	1	1	1	1	1	1	23	176	61	114	83	33	10
7	4	4	2	1	16	22	66	86	58	30	188	83	3
8	17	23	2	48	2	41	34	112	28	175	45	283	8
9	18	3	5	1	1	6	62	30	23	13	112	36	25
10	17	21	1	1	1	19	8	73	82	16	3	4	1
11+	738	406	33	1	1216	259	1069	1069	417	800	463	230	37
Total	800	472	49	58	1242	407	1373	1620	702	1179	938	898	98

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	1	1	1	1	19	1	1	1	1	1	1	1	1
2	1	1	1	1	1	253	1	1	1	1	1	1	13
3	1	1	1	1	1	54	1	5	6	1	11	1	6
4	10	3	5	51	2	22	55	139	140	10	1	1	39
5	2	84	18	80	391	88	76	55	837	219	146	53	90
6	5	14	203	59	237	357	136	9	152	205	205	168	4
7	2	17	96	292	87	216	237	61	17	118	163	27	1
8	1	3	54	149	360	202	18	50	99	1	121	114	48
9	1	5	22	24	138	818	83	58	104	5	39	1	24
10	1	1	10	1	2	2	697	19	125	1	14	1	1
11+	3	9	29	30	156	237	193	89	481	167	376	79	206
Total	28	139	440	689	1394	2250	1498	487	1963	729	1078	446	433

Age	1996*	1997*	1998*	1999*	2000*	2001*	2002*	2003*	2004*	2005*	2006*	2007**	2008**
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	22	1	1	1	1	1	1	1	1	1
3	1	34	1	58	42	168	1	63	140	35	136	1	268
4	1	65	240	65	77	60	159	125	427	746	262	76	173
5	265	27	326	193	137	119	153	454	123	1498	1776	146	271
6	265	161	122	265	111	735	555	156	335	220	3010	1638	524
7	83	111	254	42	265	459	246	269	119	1047	99	2323	2406
8	95	3	135	59	130	628	259	53	175	170	138	309	1815
9	11	6	2	61	54	228	120	1	156	92	45	85	222
10	1	19	35	62	81	58	120	1	195	85	1	64	99
11+	21	76	73	180	167	742	308	291	139	128	123	213	250
Total	744	503	1191	1007	1067	3197	1923	1414	1810	4024	5593	4856	6031

* includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait.

** includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait; catch data preliminary.

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Total	2118	4174	2758	5550	9064	21848	33914	39144	25953	29059	15115	14098	1447
% SS	62.2	88.7	98.2	99.0	86.3	98.1	96.0	95.9	97.3	95.9	93.8	93.6	93.2
% AS	37.8	11.3	1.8	1.0	13.7	1.9	4.0	4.1	2.7	4.1	6.2	6.4	6.8

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total	262	595	2033	7355	24322	47974	17596	12600	33713	22464	9025	11008	5717
% SS	89.3	76.6	78.4	90.6	94.3	95.3	91.5	96.1	94.2	96.8	88.1	95.9	92.4
% AS	10.7	23.4	21.6	9.4	5.7	4.7	8.5	3.9	5.8	3.2	11.9	4.1	7.6

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	8032	7991	6782	7719	6474	5745	4790	4619	4252	14172	12001	13233	12784
% SS	90.7	93.7	82.4	87.0	83.5	44.3	59.9	69.4	57.4	71.6	53.4	63.3	52.8
% AS	9.3	6.3	17.6	13.0	16.5	55.7	40.1	30.6	42.6	28.4	46.6	36.7	47.2

Table 13. Catch-at-age of spring and autumn spawning herring for St. Mary's Bay-Placentia Bay, 1970–2008; includes 1996–2008 estimates of herring discards in the purse seine fishery and 1996–2008 estimates of herring caught for use as lobster bait.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	3	1	1	1	3	1	1	1	1	1	1	1	1
2	476	1	1	76	995	74	365	52	30	87	133	1	1
3	109	557	207	326	280	2234	391	1423	175	663	332	193	1
4	4434	116	20375	77	234	471	1906	140	1817	279	133	42	2
5	59	2111	725	15470	126	147	208	736	123	2263	153	111	3
6	76	80	5154	566	14328	1591	267	87	596	96	1270	51	8
7	645	251	365	6757	436	13858	862	50	64	614	57	338	3
8	66	45	650	93	6049	146	5622	1039	106	85	470	28	14
9	72	13	352	224	138	3391	201	3830	512	66	38	80	4
10	37	22	73	193	238	350	2256	134	3827	501	237	6	4
11+	107	96	403	315	624	1323	1361	2448	2185	4785	2971	466	69
Total	6084	3293	28306	24098	23451	23586	13440	9940	9436	9440	5795	1317	110

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	1	1	1	1	1	1	1	1	1	1	1	13	1
2	1	8	1	1	34	1	22	1	37	68	5	24	1
3	5	9	7	1	19	1	48	115	1	47	62	137	333
4	2	24	18	143	2	22	9	189	222	7	34	5	1418
5	3	36	27	19	502	163	1	64	160	363	11	36	37
6	2	6	21	28	29	2457	24	15	170	231	187	6	1
7	4	3	15	9	47	119	463	30	12	55	118	225	1
8	1	24	3	4	9	213	34	494	110	53	74	60	63
9	9	1	25	1	3	16	100	45	493	74	63	98	1
10	1	10	5	5	1	36	5	172	88	383	56	172	16
11+	39	44	125	30	11	147	34	128	948	965	1174	1042	416
Total	68	166	248	242	658	3176	741	1254	2242	2247	1785	1818	2288

Age	1996*	1997*	1998*	1999*	2000*	2001*	2002*	2003*	2004*	2005*	2006*	2007**	2008**
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	24	235	204	1	1	1	1	1	6	379	136	1	1
3	24	125	535	63	11	1	299	74	72	587	31	3	10
4	276	1	186	63	594	29	90	657	67	4	1043	1	1
5	1509	2055	59	1	160	412	196	20	3039	96	153	104	17
6	115	9606	1043	1	65	511	1444	75	943	3383	161	129	194
7	52	636	5036	253	62	169	274	1243	407	77	1201	38	228
8	40	134	294	885	300	80	125	40	382	4	73	30	1
9	69	76	357	126	131	390	20	1	198	4	40	3	10
10	20	50	39	63	36	314	204	73	135	59	128	30	134
11+	229	508	110	190	403	1199	1441	481	245	69	297	51	134
Total	2358	13427	7864	1648	1764	3106	4093	2666	5495	4664	3265	390	729

* includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait.

** includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait; catch data preliminary.

Table 13 (Cont'd.)

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	0	0	0	0	1	1	1	1	1	1	1	1	1
2	0	0	0	0	1	1	1	1	1	1	1	1	1
3	0	0	24	5	2	1	11	1	1	1	1	1	1
4	0	9	61	150	2	7	4	47	23	11	96	139	1
5	2	2	175	52	96	68	214	52	435	143	35	116	7
6	0	53	15	71	146	182	67	209	92	598	52	10	1
7	71	31	61	10	80	89	32	81	244	73	419	11	1
8	112	43	37	54	95	206	17	69	122	216	79	50	1
9	19	84	101	17	93	6	94	26	38	21	126	7	1
10	28	35	71	68	51	37	11	22	52	2	25	1	1
11+	202	314	539	737	970	677	329	526	561	348	492	29	2
Total	434	571	1084	1164	1537	1275	781	1035	1570	1415	1327	368	18

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	2	1	1	1	1	1	1	1	1
3	1	1	1	1	4	1	5	7	1	1	1	7	1
4	18	17	9	16	12	20	5	37	14	7	2	7	105
5	6	101	20	24	32	30	18	61	87	8	208	62	112
6	12	32	86	15	80	239	8	54	40	50	239	116	35
7	4	21	46	97	30	90	56	24	23	33	173	182	106
8	1	5	36	28	82	35	43	47	65	27	41	231	99
9	1	3	10	16	24	270	67	58	98	64	41	182	87
10	1	1	3	4	3	5	178	17	40	1	3	1	78
11+	4	8	24	15	12	53	164	173	495	479	863	411	282
Total	50	191	237	218	282	745	546	480	865	672	1573	1201	907

Age	1996*	1997*	1998*	1999*	2000*	2001*	2002*	2003*	2004*	2005*	2006*	2007**	2008**
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1
3	23	76	59	1	12	1	1	1	1	1	92	3	10
4	50	295	233	1	59	20	327	37	54	616	193	3	36
5	101	188	544	1	201	118	90	727	230	1108	1222	43	168
6	130	1403	268	126	89	211	277	148	1205	360	2085	317	322
7	12	1419	933	190	858	187	752	906	460	369	170	1658	926
8	26	343	752	316	115	444	453	558	431	7	159	273	1928
9	14	420	605	190	321	42	157	36	374	110	236	124	46
10	1	50	20	316	136	47	113	112	209	53	125	182	67
11+	111	958	258	379	725	594	498	326	459	177	250	794	441
Total	470	5153	3674	1522	2518	1665	2669	2851	3425	2804	4532	3397	3945

* includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait.

** includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait; catch data preliminary.

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Total	6518	3864	29390	25262	24988	24861	14221	10975	11006	10855	7122	1683	128
% SS	93.3	85.2	96.3	95.4	93.8	94.9	94.5	90.6	85.7	87.0	81.4	78.3	85.9
% AS	6.7	14.8	3.7	4.6	6.2	5.1	5.5	9.4	14.3	13.0	18.6	21.7	14.1

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total	118	357	485	460	940	3921	1287	1734	3107	2919	3358	3019	3195
% SS	57.6	46.5	51.1	52.6	70.0	81.0	57.6	72.3	72.2	77.0	53.2	60.2	71.6
% AS	42.4	53.5	48.9	47.4	30.0	19.0	42.4	27.7	27.8	23.0	46.8	39.8	28.4

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	2828	18580	11538	3170	4281	4771	6763	5517	8920	7468	7797	3787	4675
% SS	83.4	72.3	68.2	52.0	41.2	65.1	60.5	48.3	61.6	62.5	41.9	10.3	15.6
% AS	16.6	27.7	31.8	48.0	58.8	34.9	39.5	51.7	38.4	37.5	58.1	89.7	84.4

Table 14. Catch-at-age of spring and autumn spawning herring for Fortune Bay, 1970–2008; includes 1996–2008 estimates of herring discards in the purse seine fishery and 1996–2008 estimates of herring caught for use as lobster bait.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	1	1	617	23	1	1	1	1	1	1	1	1	1
2	29475	167	1515	2210	389	2	82	27	1	1	25	1	1
3	5988	23223	256	925	1314	277	15	2103	42	1	16	144	1
4	11953	6086	19690	67	552	581	318	25	2677	183	3	16	3
5	133	23525	2896	5694	130	112	228	327	62	3833	69	4	3
6	281	1165	10767	475	4435	87	129	166	237	15	1122	3	1
7	7894	5747	351	1712	250	1490	11	26	43	165	7	21	2
8	233	3514	4432	73	1094	16	338	43	139	5	183	2	36
9	16	132	991	282	36	142	36	188	52	24	1	23	1
10	225	148	34	558	117	22	188	4	326	1	11	1	5
11+	257	537	366	173	255	201	140	244	302	167	50	12	5
Total	56456	64245	41915	12192	8573	2931	1486	3154	3882	4396	1488	228	59

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	2	1	1	1	1	1	1	1	1	1	1	1
3	2	1	54	1	1	1	1	1	1	1	2	6	1
4	2	4	3	145	1	1	1	1	23	1	1	1	1
5	1	3	39	4	304	1	1	2	8	3	1	2	14
6	1	2	12	69	11	219	18	2	1	1	327	1	14
7	1	1	2	20	49	7	274	12	1	1	2	24	24
8	1	2	1	6	18	26	1	155	6	1	3	9	569
9	10	1	1	1	4	6	17	17	274	2	8	23	36
10	1	2	1	2	1	1	11	20	1	75	10	8	36
11+	18	23	15	14	38	10	24	1	72	266	217	647	728
Total	39	42	130	264	429	274	350	213	389	353	573	723	1425

Age	1996*	1997*	1998*	1999*	2000*	2001*	2002*	2003*	2004*	2005*	2006*	2007**	2008**
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	703	1	1	1	1	1	1	1
3	1	1	1	108	0	162	1	1	1	1125	1	1	39
4	232	1	1	27	544	192	1	882	1	143	1631	51	78
5	12	1	1	1	49	4907	1	0	750	214	38	2359	1
6	49	1	1	49	62	328	4029	76	20	1456	22	17	4922
7	1	1	1	864	99	195	157	7132	152	6	582	43	25
8	1	1	1	176	1339	385	144	314	6506	58	199	193	78
9	741	1	1	191	201	932	122	3	264	4925	1	156	158
10	100	68	1	1	230	367	688	67	243	399	1963	829	53
11+	700	1638	1337	1491	1450	1448	4456	3459	3815	1632	4928	6597	5229
Total	1839	1715	1347	2910	3976	9620	9601	11937	11754	9960	9367	10248	10583

* includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait.

** includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait; catch data preliminary.

Table 14 (Cont'd.).

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	7	1	7	1	1	1	1	5	1
4	1	598	1	48	9	22	9	23	1	7	4	64	1
5	334	1	84	50	87	12	38	19	36	5	3	16	7
6	1	136	25	79	65	39	26	19	6	50	3	1	2
7	443	175	185	8	12	19	13	1	25	1	3	1	1
8	816	769	44	32	27	20	1	1	12	17	1	1	1
9	412	626	310	15	5	11	27	1	6	12	1	1	1
10	1	470	125	27	1	7	1	1	1	1	1	1	1
11+	2201	1956	793	97	85	45	9	2	18	12	1	1	1
Total	4212	4734	1570	359	300	178	133	70	108	108	20	93	18

Age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1	1	1
4	1	1	17	3	1	2	3	10	1	1	1	1	1
5	1	9	4	8	4	1	6	5	1	4	1	1	1
6	2	4	26	16	7	5	1	12	8	5	3	1	1
7	1	6	12	38	11	5	6	17	1	3	11	1	25
8	1	1	7	12	25	1	31	7	3	1	1	1	31
9	1	1	4	5	10	13	3	54	1	1	1	1	10
10	1	1	1	1	5	1	17	1	3	1	1	1	1
11+	1	1	2	5	14	10	5	5	1	5	26	14	1
Total	12	27	76	91	80	41	75	114	22	24	48	24	74

Age	1996*	1997*	1998*	1999*	2000*	2001*	2002*	2003*	2004*	2005*	2006*	2007**	2008**
1	1	1	1	1	1	1	1	1	1	11	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	29	1	1	1	1	1	1	88
4	1	1	1	1	10	1	1	38	1	249	1	77	88
5	1	1	1	1	26	109	1	1522	1	451	82	78	1
6	1	1	1	1	65	357	1	228	30	337	82	52	1
7	1	1	1	27	124	138	11	270	81	373	55	182	412
8	1	1	1	1	114	109	11	304	30	6	153	122	155
9	65	1	1	1	86	0	1	114	81	207	1	17	1
10	1	1	1	1	17	167	1	152	20	22	44	1	1
11+	1	1	1	25	148	409	135	193	101	611	437	164	78
Total	75	11	11	61	591	1320	165	2824	350	2270	859	697	827

* includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait.

** includes estimates of herring discards in purse seine fishery and estimates of herring used for lobster bait; catch data preliminary.

Spring and Autumn Spawners

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Total	60668	68979	43485	12551	8873	3109	1619	3224	3990	4504	1508	321	77
% SS	93.1	93.1	96.4	97.1	96.6	94.3	91.8	97.8	97.3	97.6	98.7	71.0	76.6
% AS	6.9	6.9	3.6	2.9	3.4	5.7	8.2	2.2	2.7	2.4	1.3	29.0	23.4

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total	51	69	206	355	509	315	425	327	411	377	621	747	1499
% SS	76.5	60.9	63.1	74.4	84.3	87.0	82.4	65.1	94.6	93.6	92.3	96.8	95.1
% AS	23.5	39.1	36.9	25.6	15.7	13.0	17.6	34.9	5.4	6.4	7.7	3.2	4.9

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total	1913	1726	1358	2971	4568	10941	9766	14761	12104	12230	10226	10945	11409
% SS	96.1	99.4	99.2	97.9	87.1	87.9	98.3	80.9	97.1	81.4	91.6	93.6	92.8
% AS	3.9	0.6	0.8	2.1	12.9	12.1	1.7	19.1	2.9	18.6	8.4	6.4	7.2

Table 15. Mean weights-at-age (g) of spring and autumn spawning herring, from samples collected January to June, for White Bay–Notre Dame Bay, 1970-2008.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1																			
2						66		54											81
3		105				143		93	99	99		138	131				144		148
4		143	149		179	177	208		201	181	199	197	205	204	252	197	201	207	213
5	209	161	181		189	222	237	225	243	254	297	233	217	240	242	262	223	234	236
6	214	198	192		203	230	222	236	253	274	282	264	278	265	341	263	273	272	256
7	231	201	207		217	241	240	247	266	283		290	314	330	305	300	281	297	294
8	280	220	218		236	255	260	252	271	287	299	337	323		355	325	319	319	316
9	282	275	243		249	274	261	270	269	281	307	306	322	357	367	332	331	346	323
10	301	278	280		258	284	278	281	279	291	305	305	324		391	353	338	338	333
11+	327	309	300		291	311	305	317	311	323	328	345	350	394	388	376	375	399	414

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																30				
2				42	27								106		78	65		111	141	
3	122	124	122	130	79	74	125		106	112		116	134	126	134	127	134	152	148	167
4	179	195	171	165	159	132	131	154		145	155	170	149	195	162	155	174	179	190	189
5	234	227	212	199	189	187	166	167	230	170	176	193	185	206	198	189	208	207	218	211
6	259	249	247	229	221	210	200	201	192	196	216	214	215	260	217	235	234	242	235	248
7	279	273	278	261	253	238	226	239	223	228	245	261	238	276	245	250	253	256	268	264
8	296	296	287	277	280	271	249	254	250	242	245	302	265	283	258	244	271	289	275	281
9	329	311	312	296	300	283	286	274	259	257	259	300	330	341	266	287	291		332	307
10	336	332	330	321	305	304	288	289	292	288	294	320	327	299	272	288	300	301		313
11+	418	412	393	373	345	330	324	371	354	362	340	378	336	397	332	376	415	365	352	327

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1																			
2																			
3																			
4								198					201	253					
5		125				244		214		232		251	225	229	277	213		238	217
6		279	205			240			246	267		297	254	262	314	261	264	288	233
7		300						257	274	271	295		354		375	281	308	279	263
8		351				312	333		289	315		310	330		491	342	359	309	289
9		335	249					203	211	296			319	370	426	336		323	317
10		371	263		272				254			353			308	312	414		346
11+	323	432	300		345	363	481	350	278	325	328	374	338		440	385	465	442	375

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																				
2				16																
3		86																132	174	129
4	149		160		123	126			116	146	137	139	141	191	163	158	165	160	194	172
5	211	201	193	199	164	155	151	173	168	181	191	220	202	211	195	180	188	186	198	192
6	236	224	199	210	201	192	200	210	180	202	193	226	228	250	210	211	210	209	226	214
7	255	257	257	253	247	212	234	249	213	255	254	257	243	285	217	242	247	222	241	237
8	274	291	303	215	274	256	216	269	209	264	280	267	270	294	248	265	273	283	255	255
9	299	314	294	291	295	284	308	284	221	237	242	343	345	300	268	264	297	228	266	282
10	303	325		324	298	326	299	290		310	297	312		335	269	279	283	296	285	281
11+	362	393	358	348	375	370	296	400	332	355	388	356	343	392	274	326	355	336	370	332

Table 16. Mean weights-at-age (g) of spring and autumn spawning herring, from samples collected January to June, for Bonavista Bay–Trinity Bay, 1970-2008.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1								13						9			10		
2		40					67		49	58	59	49			53		59	69	83
3		92	103		143	152		127		124		149	125	137	130	118	121	136	129
4		146	151			183	215	221	212	204	216	244	215	211	193	198	189	205	194
5		183	184		258	225	221	242	253	255	269	275	236	284	241	249	235	222	232
6		214	237		229	234	243	262	272	310	307	313	283		289	274	281	268	255
7	260	238	231		227	254	253	265	305	304	307	329	276	339	315	300	301	324	290
8	266	255	256		274	276	272	259	271	288	311	350	323		328	343	329	344	320
9	298	287	274		291	306	293	283	286	297	317	343	332	378	333	340	371	418	353
10	307	284	303		294	320	312	296	300	308	311	331	324	399	342	365	377	326	359
11+	353	329	327		311	356	341	332	338	339	349	366	348	433	383	393	408	416	421

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1				2																
2	67	82		34	22							101	97			84				
3	141	147	132	127	108	81	101		115	143	168	139	145	136	147	129	132	163	169	167
4	216	212	202	173	171	144	133	161		172	187	186	164	186	183	175	178	187	186	196
5	259	248	257	214	211	198	172	189	203	219	207	225	194	196	218	202	212	202	214	218
6	271	264	287	254	240	224	218	215	214	238	234	243	243	239	227	233	234	245	233	263
7	282	280	286	287	284	255	237	258	235	245	246	251	261	269	284	256	262	265	268	273
8	312	293	289	284	311	295	270	271	272	254	275	276	283	277	280	291	277	292	276	305
9	352	323	322	280	299	308	291	280	287	256	282	312	288	288	294	281	284	294	296	319
10	361	347	339	308	309	306	289	308	301	293	287	325	304	301	323	303	298	302	323	327
11+	417	411	387	340	343	345	331	345	341	339	340	332	328	328	353	365	363	331	340	346

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1																	12		
2																			
3												125		161					
4								186			180	229		199	143	174	215	154	190
5		160					210		243	254	252	265	215	269	221	224	232	231	211
6		231					250	255	232	269	279	320	271	297	244	259	261	261	241
7	268	251	259			255	227	257	227	293	299	335	290	366	266	288	290	266	273
8	233	259	277			299	295	270	288	325	313	342	301	403	305	323	312	349	302
9	287		307				295	267	265	339	327	345	331	454	293	324	319	367	323
10	284	264	317						276	264	282	401		426	354	337	348		397
11+	353	342	353		345	380	363	364	344	389	379	403	374	416		393	364	535	372

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																				
2				14			13													
3	82		80	79	89	66	81										117	117	140	122
4	163	198	172	112	130	119	140		139	166	183	176	153	170	166	165	181	177	180	176
5	218	218	210	214	190	166	186	194	152	196	206	192	188	189	200	193	193	194	187	209
6	246	242	236	228	210	202	197	213	218	214	231	221	213	213	216	220	221	208	213	220
7	288	278	274	250	256	225	233	237	237	248	259	239	242	228	234	240	235	235	234	240
8	291	289	309	297	277	247	246	270	259	265	292	253	260	242	249	257	275	256	259	253
9	318	298	308	291	306	286	265	296	293	282	288	273	273	270	268	280	279	288	282	267
10	315	318	294	286	314	293	264	289	295	293	294	302	311	285	272	303	299	279	309	292
11+	373	366	356	335	360	337	349	366	368	331	330	330	318	294	308	314	332	332	330	345

Table 17. Mean weights-at-age (g) of spring and autumn spawning herring, from samples collected January to June, for St. Mary's Bay–Placentia Bay, 1970-2008.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	17				28										32				14
2	51			83	71	86	73	81	79	99	106	81	111	99	78		89	80	120
3	162	101	154	151	159	153	163	154	154	155	182	168	163	164	177	133	172	183	164
4	197	127	190	208	213	210	236	242	234	243	235	218	243	237	230	215	216	222	232
5	231	205	229	217	229	243	250	288	286	293	311	300	290	280	263	241	263	264	261
6	269	208	258	233	242	245	273	298	327	326	338	321	324	312	301	283	300	291	285
7	285	267	278	260	269	272	262	305	326	360	362	256	349	349	343	316	316	310	305
8	308	179	294	255	290	287	282	294	330	391	392	371	365	377	361	332	378	340	320
9	314	286	309	280	307	307	302	321	319	376	408	373	394	378	372	347	374	362	330
10	341	227	326	312	310	314	322	331	341	340	377	370	383	395	375	386	389	378	350
11+	383	303	351	318	338	345	349	373	393	386	437	419	414	430	434	410	453	447	419

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	30	30		22																
2	87	97	77	59	39	59			71	79	157	113	79	94	120	96	95	105		
3	162	163	140	137	130	115	107		122	130	143	135	138	136	148	127	136	143	146	126
4	242	221	211	191	189	168	171	170	112	178	175	170	166	175	181	166	186	181	197	166
5	273	266	258	242	215	219	229	224	211	205	198	192	189	202	208	218	229	220	216	213
6	291	271	278	275	267	249	264	270	251	258		228	244	230	240	234	269	242	230	235
7	311	309	297	294	292	291	278	301	278	286	264	239	266	257	246	266	280	277	268	263
8	343	328	302	301	305	322	324	353	312	300	309	271	289	278	274	277	287	275	280	280
9	362	343	331	315	317	332	347	349	317	328	298	300	280	304	309	297	291	271	288	313
10	367	347	346	331	330	330	334	388	331	326	322	306	312	301	322	315	310	272	298	297
11+	406	430	362	362	372	384	381	426	413	424	394	352	341	354	368	362	359	317	318	326

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1																			
2															45			46	
3			115	112			113			119		168	113	119	119	113	118	127	98
4	174	148	183	171		297	188	193	195	187	212	195	200	195	198	156	212	202	203
5	244	186	196	216	228	209	227	242	240	257	244	243	240	243	243	209	219	233	236
6	244	195	230	216	237	250	257	271	269	287	290	263	285	292	278	242	266	254	260
7	285	223	242	255	266	261	277	289	302	320	310	302	292	303	318	268	299	290	282
8	284	241	289	287	279	271	271	306	311	339	339	355	344	330	326	291	335	318	315
9	311	258	317	278	290	286	293	299	329	364	338	358	356	397	353	307	354	349	328
10	342	306	331	325	293	301	289	312	313	325	355		366	393	393	331	368	336	342
11+	370	330	361	240	358	365	368	371	367	399	400	406	400	408	410	385	417	396	379

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																				
2					17															
3	114	97	121	85	71	88	86		103	105	102	112	106	141	116	99	169	127	105	110
4	193	189	175	162	143	144	149	147	154	165	159	148	160	159	167	154	162	170	173	167
5	245	235	216	210	192	180	195	196	186	202	194	171	184	189	194	184	195	199	184	196
6	274	273	248	232	220	212	211	222	218	221	215	201	200	208	218	212	218	214	209	211
7	290	279	273	273	255	239	259	250	244	256	247	228	231	231	242	238	246	242	239	230
8	322	300	300	295	275	273	274	290	259	272	274	247	255	261	259	251	266	265	261	252
9	337	328	319	306	299	292	297	308	279	297	293	273	265	274	279	274	279	255	298	258
10	343	333	336	310	313	292	297	322	308	312	302	283	274	293	292	292	290	283	312	282
11+	383	378	366	350	365	364	372	403	371	371	377	332	322	332	336	325	336	304	340	316

Table 18. Mean weights-at-age (g) of spring and autumn spawning herring, from samples collected January to June, for Fortune Bay, 1970-2008.

Spring Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1			21																
2	74	100	75	13	78	127	58	55			112		104		73				
3	133	137	158	88	153	159	131	118	154		212	145	157	164	170	148			
4	191	194	206	153	205	221	202	206	209	226	234	291	221	238	221	202	209		
5	256	236	234	167	230	253	249	260	263	261	272		277	264	258	251	251	247	236
6	269	278	274	194	277	289	285	294	299	257	307		354	316	307	287	287	293	275
7	309	316	323	229	276	322	322	297	318	324	377	353	359	363	333	317	318	323	295
8	342	328	350	279	310	316	343	309	330	370	343		384	360	372	368	370	352	331
9	340	357	352	250	276	350	377	324	350	345	344	353	386	400	435	373	415	375	353
10	460	367	352	269	353	355	376	348	359		368		398	412	401	387	412	424	390
11+	408	417	397	304	374	417	419	375	396	397	399		420	426	443	439	474	460	462

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1				15			23													
2	102	112		61							79		79			69				
3	145	144	134	138	120	114	90		121	99	103		128	138	134	122	126	129	151	88
4	215	180	186	170	177	157	150	167	168	186	152	148	177	162	171	135	176	162	159	171
5	252	212	233	209	222	195	185	205	190		185	186	179	175	197	193	214	186	191	
6	268	261	244	254	240	214	218	237	226	227	217	218	214	221	210	213	235	219	254	205
7	292	293	276	288	281	257	237	256	262	250	249	226	251	264	241	221	272	252	254	239
8	322	328	289	295	297	279	265	292	285	281	279	255	260	284	268	256	266	260	247	265
9	339	348	319	309	284	294	311	309	287	292	303	296	278	307	305	282	275	260	287	259
10	356	378	338	329	287	320	311	337	317	320	323	311	303	300	307	308	301	273	262	263
11+	421	463	372	367	355	362	359	391	384	360	373	361	338	357	347	354	365	326	317	329

Autumn Spawners

Age	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1																			
2																			
3					104		97					110	98			114			
4		165		204	208	192	181	179		240	210	180	205	200	193	173	184	149	166
5	200		220	202	222	228	233	236	236	231	224	255	246	251	241	210	222	240	237
6		269	251	175	227	263	276	261	391	305	257		279	290	270	252	269	254	265
7	246	272	278	292	290	273	264	260	271		303		300	318	299	286	303	295	288
8	294	286	290	232	272	300		335	313	336				337	342	314	320	324	300
9	282	332	312		306	391	326		287	317				345	340	340	345	338	318
10		321	347	97		341								405	307	326	357	332	334
11+	375	359	407	350	337	359	426	396	388	383	430		414		369	386	395	389	372

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1																				
2																				
3	117	118				94			110		94		172		102					101
4	177	162	173	160	121	161	120		148	165		143		159	161	149	151	161	189	147
5	230	203	207	205	190	158	187	213	186	204	194	171	192	192	190	166	182	185	177	182
6	261	242	240	221	242	202	208	223	237	219	217	191	191	204	206	198	206	201	199	182
7	281	276	268	256	251	221	239	239	236	226	232	221	223	236	238	226	226	230	227	215
8	322	280	295	279	283	265	257	281	256	268	229	221	239	281	239	235	270	248	246	227
9	303	313	294	282	304	285	289	298	295	221	256	244	243	278	269	246	264	251	265	260
10	312	328	322	311	296		309	243	304		301	251	277	305	281	285	248	241	256	258
11+	383	385	370	351	336	330	380	353	385	361	340	317	312	337	314	305	309	283	285	307

Table 19. Parameters, catch data, catch rates, and effort, by stock area and year, for spring research gill net data.

Stock Area	Year	Number of Fishers	Fishing Dates Start	Fishing Dates End	Total Catch (numbers)	Catch Rate (nos. per nights fished) AS	Catch Rate (nos. per nights fished) SS	Catch Rate (nos. per nights fished) Comb.	Net Nights per Fisher
WBNDB	1988	5	14 May	17 June	17759	9	146	156	570
	1989	7	25 April	24 June	99614	61	486	547	910
	1990	7	25 April	22 June	121218	27	679	706	859
	1991	7	8 May	31 July	117333	25	685	709	827
	1992	6	6 May	7 July	139253	28	859	887	785
	1993	6	3 May	9 July	104251	67	607	674	773
	1994	7	2 May	18 July	110697	72	586	658	841
	1995	7	15 May	27 July	103011	53	560	613	840
	1996	7	7 May	11 July	114465	71	470	541	1058
	1997	7	13 May	11 July	70338	32	320	352	998
	1998	7	5 May	10 July	53055	26	246	272	975
	1999	7	5 May	16 July	46465	14	202	216	1075
	2000	6	25 April	22 July	10681	9	49	58	920
	2001	7	8 May	20 July	29934	29	107	136	1100
	2002	9	21 April	31 July	10768	10	29	39	1372
	2003	9	19 April	31 July	31444	20	91	111	1412
	2004	8	23 April	31 July	30881	45	76	121	1278
	2005	8	22 April	31 July	76674	95	207	301	1273
	2006	8	24 April	31 July	75281	155	152	307	1227
	2007	7	14 May	25 July	70388	143	198	341	1033
	2008	8	5 May	31 July	57306	126	109	233	1229
	2009	8	29 April	30 July	74184	116	101	218	1705
BBTB	1988	7	9 May	17 June	6554	1	51	53	622
	1989	8	18 April	12 June	25250	10	96	106	1189
	1990	7	10 April	6 June	28748	11	135	146	982
	1991	8	30 April	26 June	40320	20	188	209	966
	1992	8	20 April	18 June	35196	15	138	153	1152
	1993	8	23 April	15 June	28373	17	113	130	1090
	1994	8	18 April	21 June	45863	19	168	187	1227
	1995	7	9 May	27 June	20836	10	99	110	950
	1996	7	11 April	18 June	58278	29	229	259	1127
	1997	8	16 April	26 June	73135	33	279	312	1172
	1998	8	21 April	29 June	25564	19	83	102	1257
	1999	8	15 April	26 June	23290	21	60	81	1440
	2000	8	3 April	26 June	15579	16	41	57	1373
	2001	8	4 May	20 July	14303	18	32	50	1436
	2002	10	15 April	18 July	9859	4	23	27	1814
	2003	10	9 April	12 July	37597	36	72	108	1747
	2004	9	14 April	17 July	54260	82	99	181	1499
	2005	9	14 April	17 July	46422	87	75	162	1430
	2006	9	5 April	15 July	78838	115	138	253	1557
	2007	9	13 April	23 July	101092	218	147	364	1387
	2008	8	18 April	14 July	52531	108	78	186	1411
	2009	9	19 April	8 July	61376	85	62	147	2090

Table 19 (Cont'd.)

Stock Area	Year	Number of Fishers	Fishing Dates Start	Fishing Dates End	Total Catch (numbers)	Catch Rate (nos. per nights fished) AS	Catch Rate (nos. per nights fished) SS	Catch Rate (nos. per nights fished) Comb.	Net Nights per Fisher
SMBPB	1982	4	17 April	15 May	1905	4	12	16	595
	1983	5	6 April	3 June	9174	21	44	65	708
	1984	4	5 April	14 June	34405	129	116	246	700
	1985	4	10 April	6 June	35835	133	143	276	650
	1986	5	10 April	13 June	37840	98	172	270	700
	1987	5	1 April	31 May	43693	72	211	282	774
	1988	5	2 April	29 May	23140	29	141	170	681
	1989	5	4 April	7 June	21634	25	123	148	730
	1990	5	9 April	6 June	28591	53	139	192	743
	1991	5	3 April	12 June	9971	25	42	67	745
	1992	5	8 April	10 June	13264	32	55	87	765
	1993	5	5 April	11 June	10727	25	46	72	750
	1994	5	7 April	7 June	22350	36	106	142	785
	1995	5	5 April	3 June	12861	14	70	84	765
	1996	5	2 April	12 June	54047	61	266	328	825
	1997	5	4 April	4 June	30290	55	136	191	795
	1998	5	1 April	5 June	19392	41	80	121	803
	1999	5	1 April	27 May	38665	82	164	246	785
	2000	5	4 April	3 June	36152	107	125	232	780
	2001	5	5 April	8 June	37536	63	168	232	810
	2002	6	1 April	14 June	85521	145	262	407	1050
	2003	6	4 April	12 June	37122	45	147	192	965
	2004	6	5 April	18 June	22115	33	77	110	1009
	2005	6	5 April	14 June	24036	70	84	154	780
	2006	6	1 April	2 June	22020	28	79	107	1030
	2007	6	2 April	13 June	14294	48	24	72	1000
	2008	6	8 April	7 June	12553	45	20	65	965
	2009	6	4 April	13 June	33919	88	39	127	1340
FB	1982	2	16 April	22 May	799	2	10	12	325
	1983	2	11 April	16 May	10653	49	129	178	300
	1984	1	19 April	18 May	5908	71	156	227	130
	1985	2	16 April	17 May	38301	175	462	636	301
	1986	3	15 April	6 June	44175	65	399	464	476
	1987	3	8 April	22 May	63850	70	690	760	420
	1988	3	13 April	23 May	46435	37	517	554	419
	1989	3	11 April	23 May	84066	81	927	1008	417
	1990	3	17 April	24 May	48466	47	479	527	460
	1991	3	9 April	28 May	50778	36	561	597	425
	1992	3	16 April	12 June	30235	51	331	383	395
	1993	3	13 April	5 June	39774	49	413	462	430
	1994	3	13 April	10 June	62870	46	668	714	440
	1995	3	18 April	23 June	56079	74	684	758	370
	1996	3	3 April	27 May	93868	58	862	920	510
	1997	3	7 April	31 May	96821	91	980	1071	452
	1998	3	7 April	30 May	111464	51	1224	1275	437
	1999	3	1 April	26 May	90685	213	854	1067	425
	2000	3	1 April	30 May	76734	159	727	886	433
	2001	3	6 April	1 June	110487	97	1131	1228	450
	2002	4	3 April	31 May	60195	93	447	540	557
	2003	4	23 April	31 May	61701	78	463	541	570
	2004	4	3 April	31 May	40159	97	194	291	690
	2005	4	3 April	31 May	50777	105	349	453	560
	2006	4	1 April	6 June	38232	83	264	348	550
	2007	4	2 April	11 June	27116	37	181	218	622
	2008	4	13 April	16 June	42305	75	263	338	625
	2009	4	4 April	24 June	67497	83	292	375	900

Table 20. Spring research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for White Bay–Notre Dame Bay, 1988-2008, catch rates only in 2009.

Spring Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3							4.7	16.0	83.5	11.0	0.0	1.2	0.6	0.0
4							1.9	43.3	51.6	247.1	21.5	10.9	232.0	18.5
5							22.2	11.2	52.9	28.8	493.7	51.0	14.6	300.1
6							59.6	126.9	16.3	13.7	33.5	359.9	52.1	20.2
7							5.6	182.9	144.6	7.5	13.7	18.8	182.7	45.9
8							4.7	9.7	195.5	84.2	10.3	6.7	14.1	104.1
9							12.0	16.0	11.5	164.3	47.2	13.4	7.6	8.4
10							1.8	24.3	26.5	21.9	127.9	29.7	12.9	9.5
11+							34.1	56.4	97.1	106.1	110.8	115.9	69.1	52.1
Total							146.4	486.4	678.8	684.6	858.6	606.9	585.7	559.8

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.8	0.0	
3	0.0	3.2	7.9	6.5	0.3	0.5	11.0	3.6	5.5	7.0	0.3	0.2	32.8	
4	0.9	0.6	117.6	70.3	2.6	44.2	3.0	65.9	11.3	30.6	69.4	6.9	6.7	
5	47.9	3.2	0.2	85.1	14.8	8.1	4.7	2.7	43.9	41.5	10.0	137.1	1.3	
6	286.0	77.1	1.2	1.0	16.8	37.5	3.6	9.5	2.8	85.3	8.3	17.0	54.2	
7	12.7	139.5	10.3	0.4	0.2	15.5	2.1	1.3	2.0	1.4	36.5	7.3	2.4	
8	21.6	8.6	43.3	9.5	0.9	0.1	0.7	4.6	1.7	0.8	2.3	17.4	2.9	
9	74.2	17.6	1.7	15.0	0.4	0.2	0.2	1.5	1.5	6.8	0.0	0.0	2.5	
10	5.2	31.0	6.9	2.8	0.6	0.6	0.5	1.2	0.6	3.3	1.1	5.3	2.3	
11+	21.1	39.4	56.8	18.0	12.1	0.1	3.0	0.7	6.1	29.7	23.3	5.7	3.5	
Total	469.5	320.0	246.0	202.1	48.7	106.8	28.9	91.1	75.6	206.6	151.5	197.6	108.6	101.4

Autumn Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3							0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
4							0.0	0.0	2.3	1.6	0.0	0.0	0.6	2.3
5							0.7	6.8	2.5	2.7	1.7	6.8	1.8	13.1
6							1.3	1.8	2.3	1.4	14.2	17.9	9.1	6.9
7							0.7	4.4	0.9	1.6	2.2	13.8	12.0	7.9
8							0.6	4.4	1.4	1.0	0.2	2.4	11.1	4.3
9							4.5	6.3	1.9	2.9	1.2	1.3	4.0	3.9
10							0.1	19.9	0.2	0.0	0.3	0.3	0.1	4.1
11+							1.4	17.1	16.0	13.6	8.6	25.0	33.8	10.9
Total							9.4	61.0	26.8	24.8	28.4	67.4	72.4	53.3

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	
4	0.0	0.6	1.2	0.2	0.0	1.5	2.0	2.4	13.6	5.3	1.4	9.3	0.5	
5	3.4	0.9	5.0	3.2	2.0	12.8	1.7	6.1	4.6	52.6	17.9	30.2	21.7	
6	29.6	2.6	2.4	5.5	2.7	10.3	2.1	0.7	10.4	4.8	88.5	34.1	12.9	
7	3.4	14.5	0.7	0.4	1.5	1.8	2.7	7.2	2.7	5.6	5.7	37.8	42.2	
8	10.4	2.0	8.9	0.2	1.3	1.8	1.3	1.5	3.5	2.4	8.1	6.2	37.3	
9	8.8	2.6	1.7	2.8	0.4	0.3	0.1	1.0	1.9	0.5	0.2	0.1	7.0	
10	4.1	1.2	1.7	0.6	0.6	0.1	0.1	0.7	5.3	4.1	4.2	10.4	1.0	
11+	11.7	8.1	4.5	1.1	0.8	0.6	0.4	0.6	3.3	19.5	29.2	14.7	1.7	
Total	71.4	32.4	26.1	14.0	9.3	29.3	10.4	20.3	45.2	94.6	155.2	143.1	124.5	116.2

Spring and Autumn Spawners

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total							155.8	547.3	705.6	709.4	887.0	674.3	658.1	613.2
% SS							94.0	88.9	96.2	96.5	96.8	90.0	89.0	91.3
% AS							6.0	11.1	3.8	3.5	3.2	10.0	11.0	8.7

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total	541.0	352.4	272.1	216.1	58.1	136.1	39.2	111.4	120.8	301.2	306.8	340.7	233.1	217.6
% SS	86.8	90.8	90.4	93.5	83.9	78.5	73.6	81.8	62.6	68.6	49.4	58.0	46.6	46.6
% AS	13.2	9.2	9.6	6.5	16.1	21.5	26.4	18.2	37.4	31.4	50.6	42.0	53.4	53.4

Table 21. Spring research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for Bonavista Bay–Trinity Bay, 1988-2008, catch rates only in 2009.

Spring Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2							0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
3							5.6	2.3	8.8	0.9	0.3	2.6	0.7	0.0
4							0.3	21.8	8.2	50.1	1.2	1.7	16.6	34.3
5							2.3	0.9	27.7	12.0	46.2	8.2	9.6	8.2
6							29.2	5.5	4.5	27.9	8.1	50.6	12.6	1.7
7							0.5	57.7	12.2	3.2	10.3	6.4	65.0	4.6
8							0.4	0.9	60.8	19.8	2.3	7.0	6.5	19.9
9							0.6	0.6	0.8	62.3	17.6	3.7	8.9	2.6
10							0.0	0.7	3.2	3.8	34.8	13.1	7.5	3.0
11+							12.2	5.5	8.9	8.3	16.8	20.2	40.1	25.0
Total							51.2	96.1	135.1	188.2	137.6	113.5	167.6	99.2

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.0	0.0	0.0	
3	0.0	2.8	1.2	0.1	0.1	3.4	11.0	2.5	1.1	11.6	1.1	2.2	4.6	
4	0.9	0.0	5.7	17.6	2.6	3.3	5.8	47.3	9.3	4.6	53.5	6.8	4.1	
5	140.9	3.3	0.2	7.2	11.9	2.0	2.3	12.2	68.3	6.3	11.1	69.6	1.7	
6	20.8	181.9	1.7	0.4	5.8	10.0	0.6	2.9	13.1	40.6	8.0	14.1	37.3	
7	5.3	23.7	62.3	0.8	0.4	3.0	1.5	0.4	2.5	5.1	52.4	9.5	4.4	
8	5.5	5.6	4.6	29.8	0.2	0.5	0.5	1.5	0.8	2.5	2.8	38.9	2.5	
9	20.8	7.0	2.1	1.4	12.7	0.9	0.1	0.6	0.3	0.1	1.7	1.5	13.3	
10	3.7	16.7	1.3	0.3	4.1	3.8	0.0	0.9	0.8	1.5	1.9	0.9	5.5	
11+	31.4	38.2	5.9	2.3	2.6	5.1	1.2	3.7	2.6	2.9	5.9	3.7	4.7	
Total	229.1	278.9	83.0	59.9	40.5	32.1	23.0	72.1	98.6	75.1	138.2	146.9	78.0	61.6

Autumn Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3							0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4							0.0	0.1	0.0	0.1	0.0	0.1	0.2	0.6
5							0.3	0.3	0.4	3.8	0.5	1.7	1.9	2.1
6							0.2	0.3	0.2	2.1	2.5	5.0	3.7	1.3
7							0.2	1.9	0.9	1.1	1.0	3.9	5.4	1.6
8							0.0	1.3	1.2	0.7	0.5	0.8	3.2	2.0
9							0.5	0.5	1.2	2.2	0.7	0.4	0.8	0.2
10							0.0	3.3	0.1	0.7	0.4	0.1	0.4	0.1
11+							0.3	2.4	7.3	9.8	9.5	4.6	3.7	2.6
Total							1.5	10.1	11.3	20.5	15.1	16.7	19.2	10.4

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2	0.0	1.9	
4	0.0	0.7	0.8	0.6	0.2	0.1	0.7	1.6	7.9	19.2	1.3	0.0	5.7	
5	2.7	0.2	3.6	4.0	2.4	3.7	0.9	7.3	11.5	31.9	21.6	5.9	5.7	
6	12.3	5.1	0.7	5.9	2.9	5.5	0.8	3.3	28.9	8.7	51.6	71.8	9.1	
7	1.7	13.3	2.9	1.4	4.3	2.1	1.0	8.6	12.4	12.0	8.6	105.1	34.5	
8	3.6	2.7	7.1	2.5	2.7	1.5	0.3	5.3	6.3	2.9	13.9	10.4	38.3	
9	3.0	2.2	0.7	4.3	0.5	0.6	0.3	2.4	3.0	3.9	2.5	7.8	4.8	
10	1.9	2.0	0.8	1.0	1.3	1.5	0.1	1.6	3.3	2.1	2.5	7.6	2.8	
11+	4.2	6.9	2.2	1.3	2.0	2.7	0.1	5.3	8.9	6.4	12.8	8.7	5.1	
Total	29.5	33.1	18.7	20.9	16.2	17.7	4.2	35.5	82.4	87.2	114.9	217.6	108.2	85.3

Spring and Autumn Spawners

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total							52.7	106.2	146.4	208.7	152.8	130.2	186.9	109.7
% SS							97.2	90.5	92.3	90.2	90.1	87.2	89.7	90.5
% AS							2.8	9.5	7.7	9.8	9.9	12.8	10.3	9.5

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total	258.6	312.0	101.7	80.9	56.7	49.8	27.2	107.6	181.0	162.3	253.2	364.4	186.2	146.9
% SS	88.6	89.4	81.6	74.1	71.4	64.4	84.5	67.0	54.5	46.3	54.6	40.3	41.9	41.9
% AS	11.4	10.6	18.4	25.9	28.6	35.6	15.5	33.0	45.5	53.7	45.4	59.7	58.1	58.1

Table 22. Spring research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for St. Mary's Bay-Placentia Bay, 1982- 2008,catch rates only in 2009.

Spring Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.2	1.6	0.7	0.0	0.0	0.0	0.4	0.2	0.1	0.1	0.0	0.2	0.0	0.0
3	0.2	10.2	18.6	59.3	0.3	13.7	2.3	23.5	11.2	0.9	2.7	3.5	15.6	11.3
4	0.6	1.8	21.9	5.9	125.6	1.7	4.2	6.0	19.5	16.5	0.7	3.3	25.4	49.2
5	0.4	0.9	7.0	9.9	8.5	152.1	2.7	1.8	5.7	7.1	21.8	1.5	2.9	1.8
6	1.4	1.0	2.7	6.9	17.4	11.6	100.2	3.5	2.4	1.9	3.8	12.1	0.4	0.4
7	0.2	3.2	0.9	2.4	3.4	17.7	6.2	64.3	5.0	0.5	2.4	2.4	6.9	0.8
8	1.7	0.4	7.3	2.1	2.6	4.0	14.4	3.3	69.9	1.1	1.0	2.7	2.1	1.8
9	0.4	4.7	0.2	8.6	0.1	2.1	3.0	12.6	2.4	8.3	1.6	1.1	3.8	1.2
10	0.4	0.5	10.1	2.7	2.4	0.6	0.1	3.1	16.7	1.1	7.5	2.1	3.2	0.3
11+	6.5	19.4	47.0	45.4	12.1	7.4	7.2	4.9	6.8	4.8	13.1	17.2	45.6	3.5
Total	11.9	43.8	116.3	143.1	172.5	210.7	140.7	123.2	139.5	42.3	54.8	46.2	105.9	70.3

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.6	1.1	0.2	0.3	0.8	1.2	0.9	0.4	0.4	0.0	0.0	
3	0.0	4.1	22.6	67.7	11.6	5.4	106.3	1.0	1.3	14.8	0.5	0.2	0.1	
4	54.9	0.3	5.5	21.4	74.2	5.9	1.8	117.4	3.0	0.3	41.2	1.2	0.1	
5	159.8	20.4	0.3	8.0	13.8	98.2	6.0	3.1	60.5	2.0	0.2	17.4	0.7	
6	9.3	66.7	10.1	0.0	6.1	21.4	46.1	0.3	3.4	36.0	2.4	0.6	12.3	
7	5.9	12.6	26.2	13.0	0.1	9.8	7.9	10.9	0.8	1.4	21.5	1.9	3.5	
8	1.9	2.4	4.4	31.2	2.2	6.6	1.8	2.6	2.5	3.8	0.2	1.9	2.0	
9	5.9	2.2	1.3	4.4	3.2	8.6	0.8	3.5	2.7	19.3	2.7	0.2	0.6	
10	0.8	0.5	1.0	2.1	1.5	9.8	7.1	0.1	0.5	1.9	3.1	0.2	0.7	
11+	28.0	26.8	7.9	15.1	11.6	2.5	83.3	6.8	0.9	4.3	4.7	0.0	0.0	
Total	266.3	135.8	79.8	164.3	124.7	168.4	261.9	147.1	76.5	84.1	79.0	23.7	19.9	38.7

Autumn Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
3	0.6	0.4	6.2	0.9	0.7	2.0	0.0	0.1	0.1	0.3	0.0	0.1	0.3	0.3
4	0.6	9.3	10.9	36.8	8.0	4.6	1.1	1.8	1.0	2.3	1.1	1.4	5.4	5.6
5	2.0	1.7	53.6	14.2	16.6	8.2	1.2	3.8	4.5	8.1	3.7	3.8	2.2	2.6
6	0.2	4.8	16.0	39.0	10.2	14.9	2.9	1.5	2.8	2.3	5.4	3.8	2.0	0.1
7	0.0	0.9	22.9	14.4	42.2	8.5	5.2	3.8	2.9	0.9	1.6	3.8	2.8	0.8
8	0.2	0.4	1.6	12.2	10.4	20.6	5.0	2.8	3.3	2.3	0.8	1.4	4.1	1.4
9	0.1	0.7	4.1	1.5	3.6	7.5	8.3	2.0	6.7	1.5	1.9	0.6	1.9	0.6
10	0.0	0.4	0.8	2.5	1.5	0.7	1.2	5.0	2.0	0.9	1.0	0.6	0.7	0.1
11+	0.5	2.4	13.6	10.9	4.5	4.6	4.4	4.3	29.7	6.0	16.4	9.7	16.9	2.3
Total	4.1	21.0	129.4	132.5	97.8	71.6	29.2	24.9	52.9	24.6	31.9	25.3	36.4	13.8

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	4.3	0.8	3.6	1.1	0.1	0.3	0.5	0.4	0.1	0.1	0.5	2.1	
4	0.9	3.5	12.0	10.8	22.4	3.6	3.3	1.5	5.3	9.5	2.0	6.7	2.7	
5	13.8	2.7	4.7	15.6	20.2	11.0	6.0	13.7	2.6	11.0	7.6	8.0	5.9	
6	17.8	8.9	2.6	19.8	22.8	12.9	47.7	2.0	15.1	5.1	9.3	13.8	5.3	
7	3.6	13.7	5.2	5.1	25.2	12.4	54.7	7.2	2.8	7.3	1.1	15.2	15.8	
8	5.8	2.1	7.9	4.5	8.5	18.7	11.9	11.7	3.0	4.3	4.8	3.0	12.2	
9	5.8	4.0	2.1	6.9	3.3	2.3	9.7	2.6	2.3	5.8	0.5	0.1	0.2	
10	2.6	3.0	1.3	1.8	1.4	2.0	8.4	0.3	0.5	25.0	1.3	0.3	0.8	
11+	11.1	12.6	4.4	13.8	2.2	0.4	3.2	5.8	1.1	1.7	1.3	0.1	0.2	
Total	61.3	54.7	40.9	82.0	107.1	63.3	145.4	45.2	33.1	70.0	27.9	47.8	45.1	87.8

Spring and Autumn Spawners

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total	16.0	64.8	245.8	275.7	270.3	282.3	169.9	148.2	192.4	66.9	86.7	71.5	142.4	84.1
% SS	74.4	67.6	47.3	51.9	63.8	74.6	82.8	83.2	72.5	63.2	63.2	64.6	74.4	83.6
% AS	25.6	32.4	52.7	48.1	36.2	25.4	17.2	16.8	27.5	36.8	36.8	35.4	25.6	16.4

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total	327.6	190.5	120.8	246.3	231.7	231.7	407.2	192.3	109.6	154.1	106.9	71.5	65.0	126.5
% SS	81.3	71.3	66.1	66.7	53.8	72.7	64.3	76.5	69.8	54.6	73.9	33.1	30.6	30.6
% AS	18.7	28.7	33.9	33.3	46.2	27.3	35.7	23.5	30.2	45.4	26.1	66.9	69.4	69.4

Table 23. Spring research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for Fortune Bay, 1982-2008, catch rates only in 2009.

Spring Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0
3	0.6	8.4	0.0	14.3	0.0	0.0	0.0	12.1	98.8	0.6	0.3	0.0	1.3	0.0
4	0.8	6.0	22.1	2.8	224.0	0.0	0.0	0.9	1.4	54.4	3.6	0.0	32.1	22.6
5	0.6	3.9	15.0	204.5	8.8	532.2	3.1	0.9	0.0	16.8	61.3	9.1	14.0	85.4
6	0.1	3.1	6.1	69.2	69.9	11.7	420.7	15.8	0.0	2.2	11.6	140.4	21.4	8.9
7	0.2	2.4	1.4	15.7	48.3	48.3	9.8	659.3	6.2	1.7	1.3	5.0	252.5	19.8
8	6.0	2.7	4.1	4.6	10.0	20.7	50.6	14.8	236.8	21.9	1.7	3.7	3.3	258.4
9	0.3	44.0	0.3	8.8	0.8	4.8	11.4	64.9	19.7	283.8	6.3	0.0	12.0	39.0
10	0.8	4.6	4.4	6.5	2.0	1.4	2.1	33.4	59.0	38.1	70.3	9.5	12.0	12.3
11+	0.8	53.7	102.5	135.3	35.9	71.8	19.6	124.3	56.1	141.4	175.0	245.3	319.3	237.2
Total	10.3	128.7	156.0	461.6	399.3	690.2	516.8	927.3	479.4	560.9	331.4	413.0	668.0	683.6

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	
3	0.0	0.0	2.4	82.8	0.0	0.0	8.1	0.0	2.9	44.6	3.4	0.5	0.0	
4	19.0	0.0	3.7	36.7	124.2	1.1	0.9	19.0	3.1	0.7	167.5	2.9	0.0	
5	134.5	89.2	0.0	21.3	40.7	235.2	4.9	0.9	44.8	2.1	9.0	102.6	0.0	
6	112.1	193.1	514.2	15.4	8.7	49.7	194.2	5.6	7.0	40.1	2.9	2.2	108.5	
7	12.1	103.9	144.5	245.8	10.9	65.6	23.3	246.2	2.3	3.1	15.6	3.4	9.0	
8	19.0	19.6	161.6	161.3	124.2	75.8	6.3	16.7	62.1	3.8	1.8	4.2	15.5	
9	187.1	17.6	19.6	40.1	109.7	122.1	5.8	3.7	3.9	107.0	6.9	1.4	1.8	
10	19.0	104.9	28.2	21.3	55.9	117.6	11.6	0.9	2.3	9.8	16.1	0.9	3.2	
11+	360.4	451.8	350.2	230.4	251.4	463.6	192.8	169.4	65.0	137.4	40.9	62.6	125.9	
Total	862.3	980.0	1224.3	853.5	726.6	1130.6	447.4	462.8	194.1	348.6	264.1	180.9	263.3	291.7

Autumn Spawners

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.1	0.0	0.0	0.0	7.4	2.2	0.0	0.0	0.0	0.7	0.0
4	0.3	18.0	0.0	13.8	8.5	0.1	0.2	0.2	6.6	1.9	1.1	0.1	0.1	0.0
5	1.4	6.0	31.1	7.9	5.0	3.3	0.1	3.6	1.0	4.4	6.3	3.5	2.8	9.5
6	0.2	20.6	11.8	73.9	9.3	4.0	3.0	1.4	2.0	1.7	9.2	5.8	7.6	3.9
7	0.0	2.0	19.5	38.6	28.2	4.5	3.8	11.1	1.4	1.2	5.2	17.5	8.0	16.8
8	0.0	1.1	4.1	17.5	9.0	25.6	3.0	8.8	4.7	1.4	3.7	3.3	15.2	14.2
9	0.0	0.5	1.0	13.8	2.0	10.0	12.2	3.1	9.4	1.6	5.8	0.9	0.5	10.9
10	0.0	0.0	0.2	3.3	1.0	5.2	1.1	20.6	0.5	5.5	2.1	0.0	0.0	0.2
11+	0.1	0.7	3.5	5.9	1.7	17.3	13.9	24.6	19.6	18.5	17.9	18.4	11.5	18.7
Total	2.0	48.9	71.3	174.6	64.8	69.9	37.3	80.7	47.4	36.4	51.3	49.5	46.4	74.3

Age	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	
4	0.0	0.0	4.2	0.0	11.2	0.0	7.4	0.4	14.8	15.9	4.7	2.8	0.7	
5	4.7	0.0	2.1	7.7	8.1	5.3	3.4	12.6	12.1	27.3	13.9	3.3	7.8	
6	11.0	5.4	12.8	26.9	2.1	12.8	24.5	0.5	43.6	21.7	28.4	11.0	1.2	
7	3.1	32.1	4.2	28.8	53.9	9.3	23.2	19.1	1.9	15.4	9.9	10.7	9.9	
8	7.8	10.7	17.0	53.8	5.4	13.2	1.9	11.5	5.5	2.6	5.9	4.2	36.3	
9	3.1	10.7	2.1	34.6	14.4	34.6	7.5	5.5	10.1	5.9	2.7	1.0	2.1	
10	1.6	7.1	0.0	15.4	3.3	10.8	1.9	4.0	3.2	1.9	5.8	1.1	3.0	
11+	26.6	25.0	8.5	46.1	60.9	11.0	23.0	24.1	5.6	14.0	12.2	3.0	14.1	
Total	58.0	91.0	51.0	213.4	159.5	97.0	92.9	78.5	96.9	104.7	83.4	37.1	75.1	83.2

Spring and Autumn Spawners

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Total	12.3	177.6	227.2	636.2	464.0	760.1	554.1	1008.0	526.8	597.4	382.7	462.5	714.4	757.8
% SS	83.7	72.5	68.6	72.6	86.0	90.8	93.3	92.0	91.0	93.9	86.6	89.3	93.5	90.2
% AS	16.3	27.5	31.4	27.4	14.0	9.2	6.7	8.0	9.0	6.1	13.4	10.7	6.5	9.8

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total	920.3	1071.0	1275.3	1066.9	886.1	1227.6	540.4	541.2	291.0	453.4	347.6	218.0	338.4	375.0
% SS	93.7	91.5	96.0	80.0	82.0	92.1	82.8	85.5	66.7	76.9	76.0	83.0	77.8	77.8
% AS	6.3	8.5	4.0	20.0	18.0	7.9	17.2	14.5	33.3	23.1	24.0	17.0	22.2	22.2

Table 24. Fall research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for White Bay–Notre Dame Bay, 1980-91.

Spring Spawners

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0
2	9.8	4.5	8.5	0.5	23.3	2.6	0.2	1.2	5.7	5.2	3.2	0.3
3	8.1	5.2	29.1	50.1	6.4	134.5	9.0	0.6	3.9	10.8	120.9	5.2
4	204.1	1.2	5.6	81.4	19.1	19.0	107.3	38.8	3.6	20.1	21.1	262.1
5	7.2	25.2	3.5	7.3	84.0	11.6	12.5	352.0	18.0	7.6	7.0	15.8
6	92.2	1.0	1.9	14.1	4.2	60.1	9.0	35.1	90.4	39.2	3.5	2.4
7	2.7	5.3	0.8	19.8	8.5	7.1	38.2	16.0	7.8	123.8	12.1	3.1
8	29.5	0.5	9.3	2.6	14.0	6.7	3.8	57.3	6.6	4.1	51.8	10.3
9	4.5	1.9	0.0	22.4	0.8	7.5	2.6	8.6	13.3	12.2	7.3	32.3
10	34.0	0.8	15.5	5.2	8.5	5.2	3.1	5.5	1.2	25.6	10.8	1.7
11+	503.9	83.7	192.6	318.7	254.8	119.5	50.2	102.3	27.0	41.9	33.5	10.3
Total	895.9	129.4	266.8	522.1	423.6	373.9	235.9	617.6	177.9	290.4	271.3	343.5

Autumn Spawners

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
3	3.3	0.3	7.0	0.0	14.0	0.0	0.0	0.0	0.1	0.0	1.3	0.0
4	0.4	1.0	3.4	14.2	2.1	1.5	2.9	15.7	2.2	0.7	4.5	3.0
5	1.5	0.0	3.8	1.6	40.9	1.5	3.9	20.3	3.2	0.4	1.6	7.3
6	1.8	0.4	3.3	4.2	10.2	13.9	3.3	15.1	1.5	0.1	0.4	0.6
7	1.8	0.0	0.0	1.4	1.3	7.6	10.2	2.8	0.8	2.6	0.3	0.2
8	0.1	0.3	0.0	0.2	1.1	0.0	2.6	8.5	0.4	0.7	0.4	0.0
9	0.2	0.0	1.5	0.3	0.3	0.0	0.4	2.9	1.7	0.0	0.5	0.4
10	0.0	0.0	0.0	0.9	0.2	0.0	0.0	2.1	0.4	2.2	0.3	0.2
11+	4.3	0.3	0.4	1.9	3.3	2.3	1.3	1.1	1.0	1.7	1.9	1.5
Total	13.3	2.2	19.5	24.7	73.5	26.8	24.6	68.5	11.6	8.4	11.2	13.2

Spring and Autumn Spawners Combined

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total	909.2	131.6	286.3	546.8	497.0	400.7	260.5	686.2	189.5	298.8	282.5	356.7
%SS	98.5	98.3	93.2	95.5	85.2	93.3	90.5	90.0	93.9	97.2	96.0	96.3
%AS	1.5	1.7	6.8	4.5	14.8	6.7	9.5	10.0	6.1	2.8	4.0	3.7

Table 25. Fall research gill net catch rates at age (numbers per nights fished), of spring and autumn spawning herring, for Bonavista Bay–Trinity Bay, 1980-91.

Spring Spawners

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.1	0.0	0.0
2	20.6	1.3	4.6	1.0	18.3	2.2	2.4	3.7	4.9	9.7	1.8	0.9
3	1.3	1.9	73.0	8.1	7.6	50.3	5.8	0.3	14.7	3.0	39.9	2.2
4	12.8	0.2	19.8	101.9	7.4	4.0	109.9	4.4	1.5	10.3	10.2	56.4
5	0.9	0.8	5.0	11.0	57.3	1.8	2.1	43.9	6.3	1.1	8.3	8.1
6	4.3	0.2	14.6	4.3	2.3	8.0	2.2	1.9	50.9	4.2	0.5	14.0
7	0.3	1.6	0.1	11.5	1.3	5.1	4.6	1.7	1.9	20.8	2.9	1.1
8	0.9	0.0	3.0	0.2	2.0	0.1	0.6	1.6	1.6	0.5	13.4	7.5
9	0.1	1.2	0.0	4.5	0.0	0.6	0.1	0.5	1.1	1.0	1.3	33.2
10	1.9	0.1	0.6	1.0	1.9	0.0	0.8	0.2	0.2	1.0	1.2	2.1
11+	101.2	61.8	64.8	95.9	44.6	17.6	10.4	6.3	3.9	2.4	4.4	6.9
Total	144.2	69.0	185.5	239.4	142.6	89.7	138.8	64.5	87.6	54.0	83.9	132.5

Autumn Spawners

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.1	0.0
3	0.8	0.0	20.3	0.2	0.4	0.4	0.2	0.0	0.1	0.2	0.4	0.0
4	1.2	1.3	3.3	33.6	1.2	0.9	0.7	0.3	0.5	0.2	1.6	1.6
5	0.5	0.2	10.9	8.5	23.3	0.8	2.4	0.7	0.9	0.4	0.5	2.5
6	1.2	0.2	0.4	10.0	5.0	8.8	2.8	0.7	1.1	0.9	0.2	0.4
7	2.5	0.2	1.8	2.3	4.9	3.8	7.7	0.5	0.6	0.8	0.4	0.4
8	0.6	2.4	0.1	1.5	0.5	0.8	2.0	2.8	0.1	0.5	0.2	0.3
9	0.3	0.0	5.3	0.6	1.9	0.3	1.3	0.7	1.3	0.1	0.4	0.4
10	0.0	0.0	0.0	4.4	0.0	0.0	0.1	0.1	0.4	0.8	0.0	0.9
11+	2.0	1.2	5.6	4.5	4.4	1.2	1.0	0.6	1.7	0.5	0.5	1.9
Total	9.0	5.5	47.7	65.6	41.6	17.0	18.2	6.5	7.0	4.2	4.2	8.4

Spring and Autumn Spawners Combined

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total	153.3	74.5	233.2	305.0	184.2	106.7	157.1	71.0	94.6	58.2	88.1	140.9
%SS	94.1	92.6	79.5	78.5	77.4	84.0	88.4	90.8	92.6	92.8	95.2	94.0
%AS	5.9	7.4	20.5	21.5	22.6	16.0	11.6	9.2	7.4	7.2	4.8	6.0

Table 26. Acoustic survey biomass estimates (t), by stock area, 1983-2000.

Year	White Bay / Notre Dame Bay	Bonavista Bay / Trinity Bay	St. Mary's Bay / Placentia Bay	Fortune Bay
1983	136000	-	-	-
1984	78700	59800	-	-
1985	198400	99900	-	-
1986	126200	25700	42200	9100
1987	30900	10400	-	-
1988	22500	29700	-	-
1989	-	-	-	-
1990	-	51900	32700	14400
1991	-	-	-	-
1992	104500	-	10200	18400
1993	-	23100	-	-
1994	2100	-	29300	-
1995	-	12300	-	2500
1996	-	33000	17700	-
1997	-	-	-	15500
1998	19200	-	6300	-
1999	-	15200	-	30000
2000	-	-	2000	-

Table 27. Parameters, catch data, catch rates, effort, and abundance indices, by stock area and year, from commercial gill net logbook data.

Stock Area	Year	Number of Fishers	Mean Fisher Age	Fishing Dates Start	Fishing Dates End	Mean Mesh Size (mm)	Mean Panel Size (sq m)	Total Logbook Catch (t)	Total Comm. Landings (t)	Catch / Std. Net / Night Fished (kg)	Effort (net nights per fisher)	Current Year Abundance Index	Cumulative Abundance Index
WBNDB	1981	8	-	01-Apr	23-May	-	-	50.5	2855	68.5	825	-	-
	1983	38	-	18-Apr	14-Jul	-	-	68.0	406	41.8	2088	-	-
	1996	16	-	01-Apr	18-Jun	64.7	299	68.5	229	38.4	2970	-	-
	1997	9	45	10-May	30-Jun	63.8	205	9.2	21	36.7	1031	5.00	-0.60
	1998	13	47	15-Apr	30-Jun	62.6	237	8.7	36	14.9	1832	3.00	-3.45
	1999	5	38	20-Apr	30-Jun	63.3	363	9.7	57	17.3	1027	5.83	-0.95
	2000	8	47	15-Apr	10-Jul	63.4	310	6.8	19	22.5	727	2.69	-1.78
	2001	10	45	05-May	12-Jul	60.8	201	8.2	7	25.3	910	4.60	-1.11
	2002	8	49	30-Apr	05-Jul	60.0	243	0.8	13	2.2	719	2.30	-2.00
	2003	9	52	29-Apr	01-Jul	59.2	175	9.4	46	24.3	1405	4.00	-1.00
	2004	8	51	22-Apr	30-Jun	62.2	161	4.9	12	21.4	710	3.86	-0.75
	2005	8	50	30-Apr	18-Jun	61.9	175	6.5	12	34.3	731	5.47	0.00
	2006	10	52	02-May	12-Jul	62.9	249	17.5	27	65.9	1361	5.67	0.22
	2007	15	53	03-May	14-Jul	60.8	177	18.6	0	41.0	1515	5.45	0.70
	2008	10	56	2-May	7-Jul	62.4	241	31.1	4	117.9	713	6.39	2.48
	2009	12	56	2-May	9-Jul	61.5	205	19.7	1	96.4	597	5.31	2.74
BBTB	1981	10	-	02-Apr	04-May	-	-	33.0	1766	25.9	1291	-	-
	1983	18	-	18-Apr	25-Jun	-	-	11.5	69	15.5	823	-	-
	1996	11	-	02-Apr	05-Jun	65.3	214	51.5	378	52.6	2153	-	-
	1997	6	45	07-Apr	27-Jun	66.1	312	39.4	201	27.9	1818	8.00	0.93
	1998	6	45	02-Apr	21-Jun	66.0	245	16.3	170	13.5	1655	5.00	-1.07
	1999	5	51	02-Apr	29-Jun	66.0	330	28.7	194	27.8	657	6.00	-1.07
	2000	9	49	08-Apr	30-Jun	65.3	349	23.6	202	36.7	1018	4.27	-0.67
	2001	10	46	13-Apr	30-Jun	66.3	298	22.3	56	33.2	964	3.82	-1.31
	2002	10	53	20-Apr	21-Jun	66.5	309	6.0	38	10.2	574	2.50	-2.19
	2003	4	57	01-May	30-Jun	66.7	210	4.9	56	23.4	358	4.80	-0.94
	2004	5	63	21-Apr	30-Jun	64.3	169	6.8	24	16.6	608	3.57	-0.61
	2005	6	52	22-Apr	22-Jun	64.9	276	14.0	315	39.5	716	5.60	0.19
	2006	12	54	11-Apr	30-Jun	65.0	223	31.6	136	46.4	890	6.31	1.32
	2007	13	54	04-Apr	30-Jun	63.0	247	54.3	154	85.6	887	7.19	2.03
	2008	5	54	26-Apr	30-Jun	64.7	295	11.1	44	29.4	270	5.72	1.59
	2009	10	52	21-Apr	30-Jun	64.1	190	15.0	146	43.7	677	4.38	0.65

Table 27 (Cont'd.)

Stock Area	Year	Number of Fishers	Mean Fisher Age	Fishing Dates Start	Fishing Dates End	Mean Mesh Size (mm)	Mean Panel Size (sq m)	Total Logbook Catch (t)	Total Comm. Landings (t)	Catch / Std. Net / Night Fished (kg)	Effort (net nights per fisher)	Current Year Abundance Index	Cumulative Abundance Index
SMBPB	1983	6	-	18-Apr	29-Jun	-	-	1.2	40	3.4	320	-	-
	1996	13	-	19-Mar	15-Jun	67.1	261	45.3	37	31.4	2073	-	-
	1997	6	50	12-Feb	24-Jun	68.3	265	15.4	21	20.7	2171	3.50	-2.00
	1998	8	52	17-Mar	25-Jun	68.2	257	25.9	18	20.2	5361	2.57	-2.71
	1999	6	51	21-Feb	29-May	65.6	319	11.9	1	12.0	2981	2.75	-3.34
	2000	1	57	01-Apr	26-May	66.7	334	2.7	4	10.1	280	4.00	-3.84
	2001	3	52	28-Apr	23-Jun	65.3	226	2.0	38	10.2	235	3.00	-3.64
	2002	4	56	20-Feb	08-Jun	66.3	241	75	135	39.4	1692	5.00	-2.24
	2003	4	56	20-Mar	17-Jun	65.7	240	9.2	84	23.9	658	3.60	-2.04
	2004	2	57	08-Apr	15-Jun	64.8	259	1.1	179	5.4	332	3.67	-2.71
	2005	3	57	07-Apr	10-Jun	63.3	268	1.2	134	7.9	210	5.00	-1.51
	2006	5	56	03-Apr	05-Jun	64.6	292	3.2	150	9.1	432	3.00	-1.68
	2007	9	55	10-Mar	15-Jun	66.3	336	17.3	167	17.4	836	4.63	-1.99
	2008	7	55	15-Mar	13-Jun	65.9	223	53.4	79	36.8	1440	4.80	-3.24
	2009	3	57	4-Mar	10-Jun	65.5	263	16.7	101	42.7	537	5.00	-4.38
FB	1996	11	-	08-Apr	10-Jun	68.6	304	60	31	37.5	3044	-	-
	1997	13	50	29-Mar	28-Jun	66.9	271	68.9	28	39.4	5919	7.60	0.45
	1998	11	49	01-Apr	17-Jun	65.2	218	41.3	0	54.7	2776	7.40	1.35
	1999	8	49	21-Mar	15-Jun	65.8	313	36.1	30	37.9	1432	8.14	1.06
	2000	11	50	25-Mar	12-Jun	66.5	263	96.5	16	83.5	2364	8.45	1.56
	2001	8	54	28-Mar	21-Jun	65.6	311	54.6	0	38.2	1668	6.75	0.68
	2002	7	53	28-Mar	29-Jun	65.5	297	35.7	0	50.6	1093	6.71	0.54
	2003	7	53	08-Apr	18-Jun	66.1	283	16.3	0	36.6	581	5.00	-0.46
	2004	5	53	30-Mar	23-Jun	68.1	305	10.7	54	24.6	728	4.33	-0.79
	2005	6	55	06-Apr	19-Jun	67.4	303	8.6	5	16.0	552	5.08	-2.02
	2006	6	55	03-Apr	21-Jun	65.9	313	7.4	4	11.6	707	3.33	-3.24
	2007	15	52	9-Apr	22-Jun	64.4	?	27.7	2	30.3	1746	4.26	-3.66
	2008	13	53	2-Apr	20-Jun	64.1	224	28.8	2	49.3	1452	3.94	-4.54
	2009	12	55	2-Apr	19-Jun	62.8	238	30.2	6	35.8	1624	3.90	-5.62

Table 28. Results of the telephone survey of herring commercial gill net licence and/or bait permit holders, by stock area and year (2006-09).

Stock Area	Year	Number of Respondents Who Fished	Current Year Abundance Index	Previous Year Abundance Index	Cumulative Index
WBNDB	2005	-	-	5.29	-
	2006	40	5.68	5.46	0.45
	2007	42	5.99	4.70	0.90
	2008	32	5.63	-	1.45
	2009	37	5.80	-	1.75
BBTB	2005	-	-	4.84	-
	2006	49	5.48	5.91	0.51
	2007	50	7.09	6.44	1.89
	2008	43	6.13	-	2.02
	2009	44	5.33	-	1.85
SMBPB	2005	-	-	4.78	-
	2006	22	5.00	5.39	0.22
	2007	19	6.39	6.53	1.25
	2008	17	7.00	-	2.28
	2009	19	7.21	-	3.99
FB	2005	-	-	6.00	-
	2006	57	5.34	5.50	-0.65
	2007	52	3.75	4.55	-2.48
	2008	50	3.67	-	-4.02
	2009	46	4.17	-	-5.35

Table 29. Performance report standardization parameters, ranks, and weighting factors.

Data Source	Calculation of Ranks	Minimum Rank	Maximum Rank	Weighting Factor	Indicator of:
Research Gill Net Catch Rates (year = n) - spring and autumn spawners combined	<= 20% of mean = 1 21-40% of mean = 2 41- 60% of mean = 3 61-80% of mean = 4 81-100% of mean = 5 101-120% of mean = 6 121-140% of mean = 7 141-160% of mean = 8 161-180% of mean = 9 > 180% of mean = 10	1	10	2.0	Current Status
Commercial Gill Net Catch Rates (year = n) - from logbooks	<= 20% of mean = 1 21-40% of mean = 2 41- 60% of mean = 3 61-80% of mean = 4 81-100% of mean = 5 101-120% of mean = 6 121-140% of mean = 7 141-160% of mean = 8 161-180% of mean = 9 > 180% of mean = 10	1	10	0.5	Current Status
Gill Net Fisher Cumulative Index (year = n) - from logbooks (1997–2009)	<= -4 = 1 -4 to -3 = 2 -3 to -2 = 3 -2 to -1 = 4 -1 to 0 = 5 0 to 1 = 6 1 to 2 = 7 2 to 3 = 8 3 to 4 = 9 >= 4 = 10	1	10	0.5	Current Status
Gill Net Fisher Cumulative Index (year = n) - from phone survey (2006–2009)	<= -4 = 1 -4 to -3 = 2 -3 to -2 = 3 -2 to -1 = 4 -1 to 0 = 5 0 to 1 = 6 1 to 2 = 7 2 to 3 = 8 3 to 4 = 9 >= 4 = 10	1	10	0.5	Current Status
Purse Seine Fisher Cumulative Index (year = n–1)* * except SMBPB where year = n	<= -4 = 1 -4 to -3 = 2 -3 to -2 = 3 -2 to -1 = 4 -1 to 0 = 5 0 to 1 = 6 1 to 2 = 7 2 to 3 = 8 3 to 4 = 9 >= 4 = 10	1	10	0.5	Current Status
Research Gill Net Age Compositions (year = n-1) (number of age 3+ groups >= 5% of catch) - spring and autumn spawners combined	very poor if n = 1 average if n = 5 very good if n = 9	1	9	1.0	Current Status

Table 29 (cont.'). Performance report standardization parameters, ranks, and weighting factors.

Data Source	Calculation of Ranks	Minimum Rank	Maximum Rank	Weighting Factor	Indicator of:
Strength of Fishery Dependent Year Classes (year classes = n–6 and n–7) - spring and autumn spawners combined	<= 20% of mean = 1 21-40% of mean = 2 41- 60% of mean = 3 61-80% of mean = 4 81-100% of mean = 5 101-120% of mean = 6 121-140% of mean = 7 141-160% of mean = 8 161-180% of mean = 9 > 180% of mean = 10	1	10	1.0	Prospects
Strength of Other Mature year Classes (year classes = n–8, n–9, and n–10) - spring and autumn spawners combined	<= 20% of mean = 1 21-40% of mean = 2 41- 60% of mean = 3 61-80% of mean = 4 81-100% of mean = 5 101-120% of mean = 6 121-140% of mean = 7 141-160% of mean = 8 161-180% of mean = 9 > 180% of mean = 10	1	10	0.5	Prospects
Recruitment (year class = n–5) - spring and autumn spawners combined	<= 20% of mean = 1 21-40% of mean = 2 41- 60% of mean = 3 61-80% of mean = 4 81-100% of mean = 5 101-120% of mean = 6 121-140% of mean = 7 141-160% of mean = 8 161-180% of mean = 9 > 180% of mean = 10	1	10	0.5	Prospects

Table 30. Mean square residuals for similar illustrative ADAPT calibrations, by stock area and spawning type, 2008 (Wheeler et al. 2008) and 2009 assessments.

	Mean Square Residual	
	2008 assessment	2009 assessment
White Bay–Notre Dame Bay • Spring Spawners • Autumn Spawners	 2.42 3.19	 2.65 3.76
Bonavista Bay-Trinity Bay • Spring Spawners • Autumn Spawners	 1.92 3.01	 1.86 2.76
St. Mary's Bay-Placentia Bay • Spring Spawners • Autumn Spawners	 1.51 2.37	 1.65 2.31
Fortune Bay • Spring Spawners • Autumn Spawners	 5.52 4.88	 6.75 5.11

Table 31. Mean square residuals for a series of illustrative "retrospective" ADAPT calibrations, spring spawners only.

	Mean Square Residual		
	1970 to 2000; revised catch matrix; all indices.	1970 to 2000; revised catch matrix; research gill net and acoustic indices only.	1970 to 2000; old catch matrix; research gill net and acoustic indices only.
White Bay–Notre Dame Bay	1.41	1.45	1.41
Bonavista Bay–Trinity Bay	1.92	2.01	2.01
St. Mary's Bay–Placentia Bay	1.30	1.37	1.36
Fortune Bay	7.49	7.80	7.65

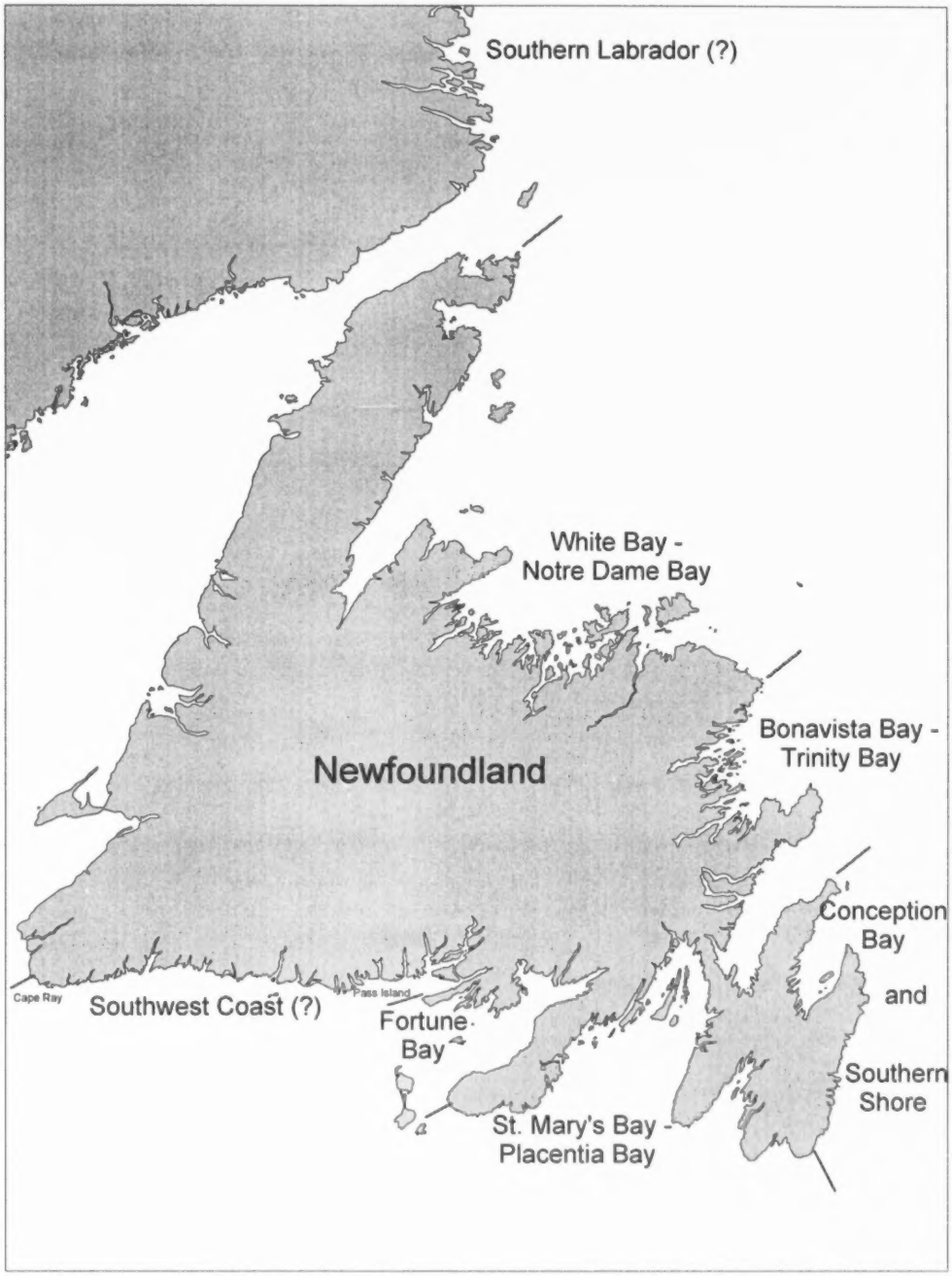


Figure 1. Area map indicating herring stock complexes within the Newfoundland and Labrador Region.

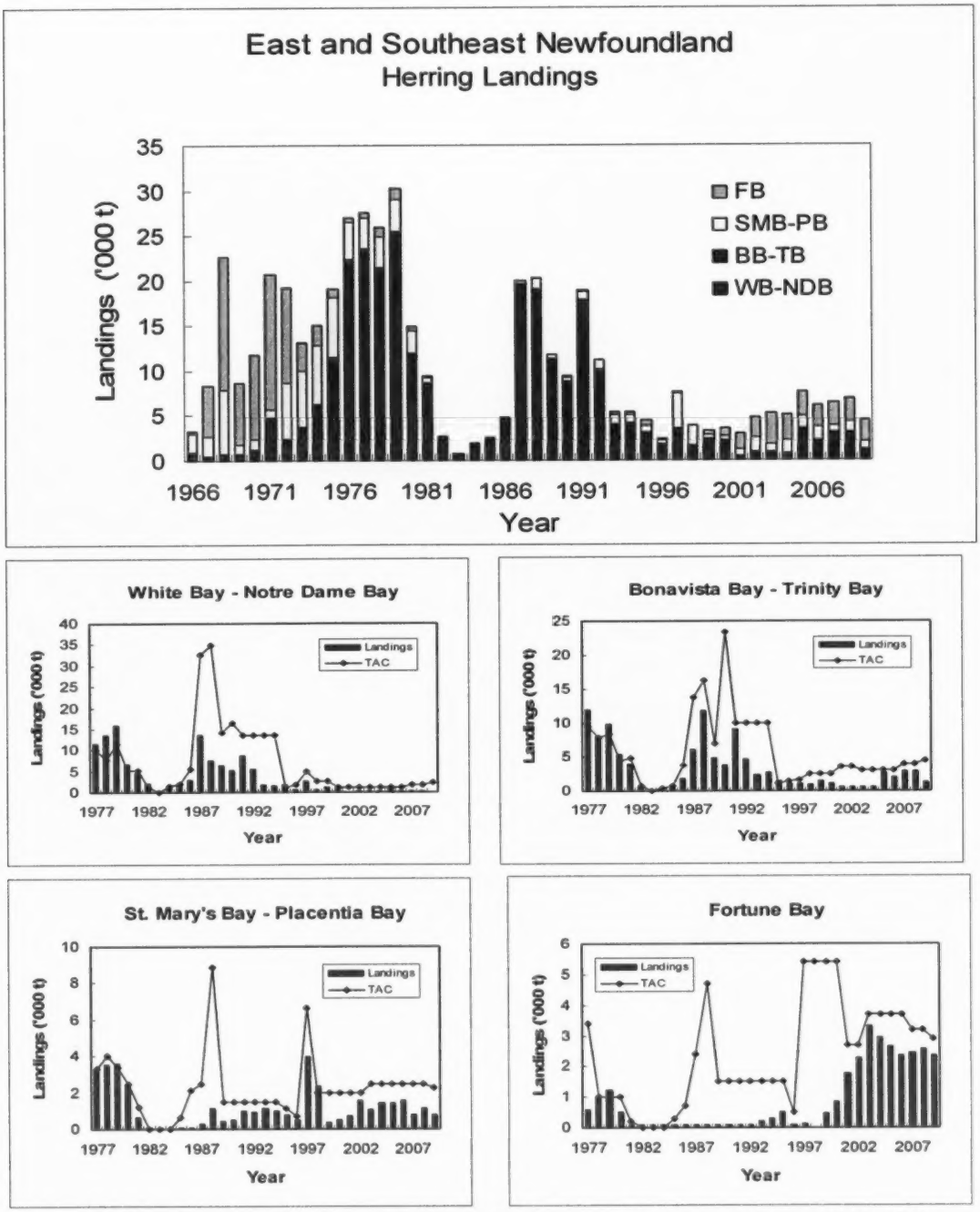


Figure 2. East and southeast Newfoundland herring landings and TAC's, by stock area, 1966–2009. Landings are from Policy and Economics Branch and do not include herring discards or herring used as bait.

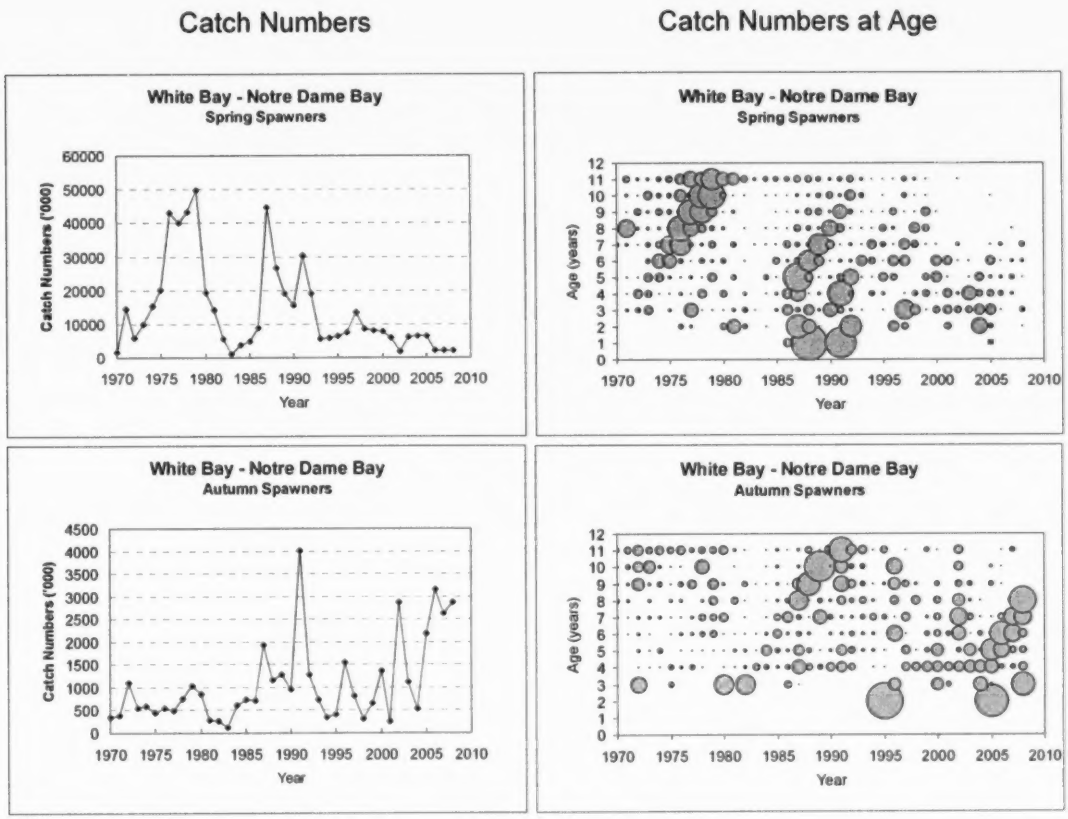


Figure 3. Commercial catch numbers (left panels) and numbers at age normalized by age (right panels), by spawning type, White Bay–Notre Dame Bay, 1970-2008. Catch numbers and numbers at age include herring discards and herring used as bait.

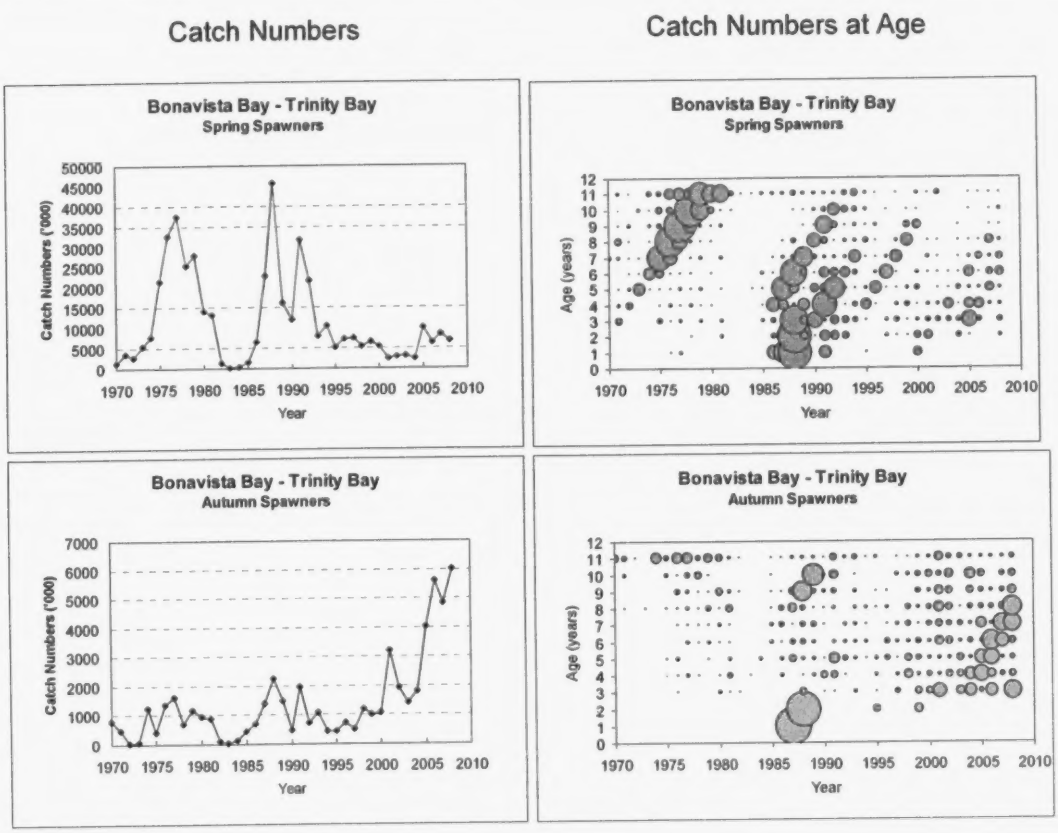


Figure 4. Commercial catch numbers (left panels) and numbers at age normalized by age (right panels), by spawning type, Bonavista Bay-Trinity Bay, 1970-2008. Catch numbers and numbers at age include herring discards and herring used as bait.

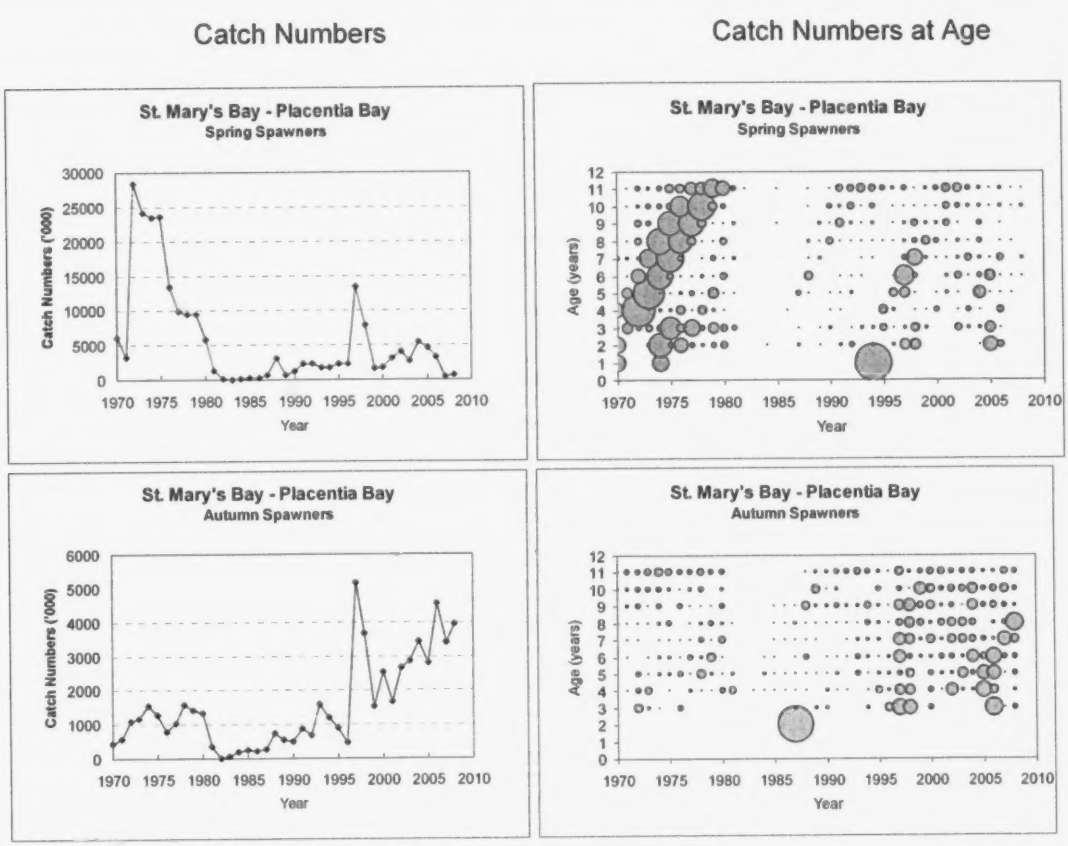


Figure 5. Commercial catch numbers (left panels) and numbers at age normalized by age (right panels), by spawning type, St. Mary's Bay-Placentia Bay, 1970-2008. Catch numbers and numbers at age include herring discards and herring used as bait.

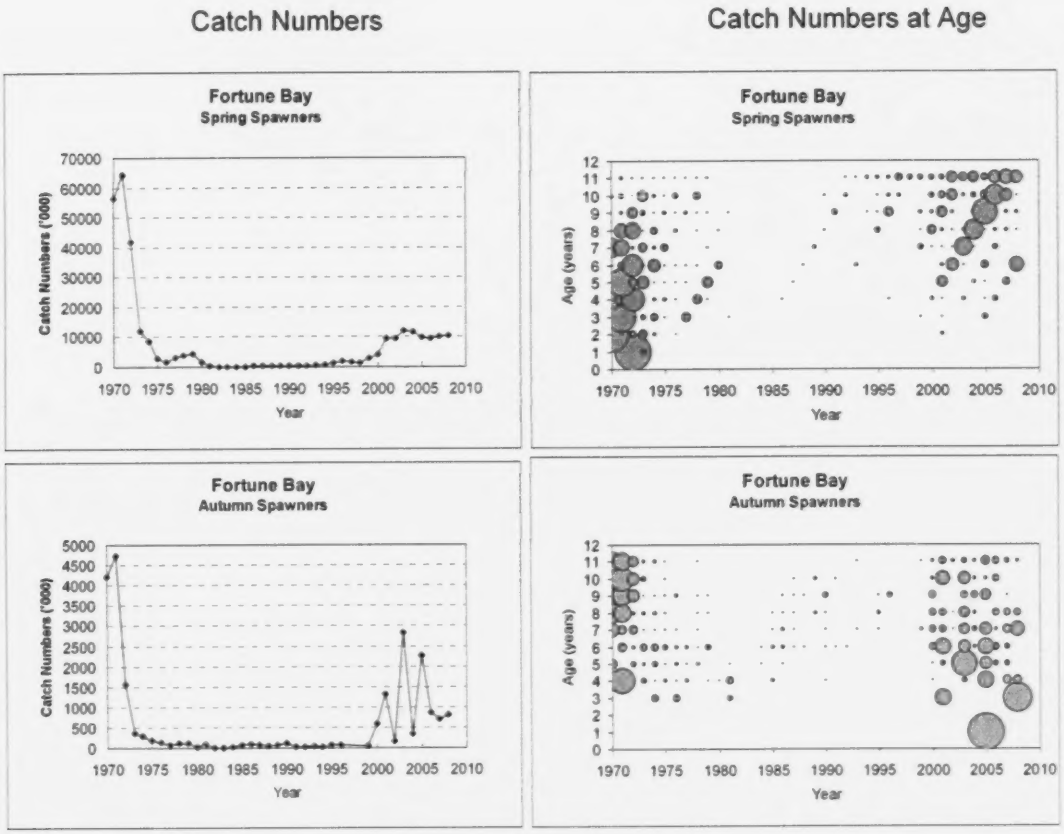


Figure 6. Commercial catch numbers (left panels) and numbers at age normalized by age (right panels), by spawning type, Fortune Bay, 1970-2008. Catch numbers and numbers at age include herring discards and herring used as bait.

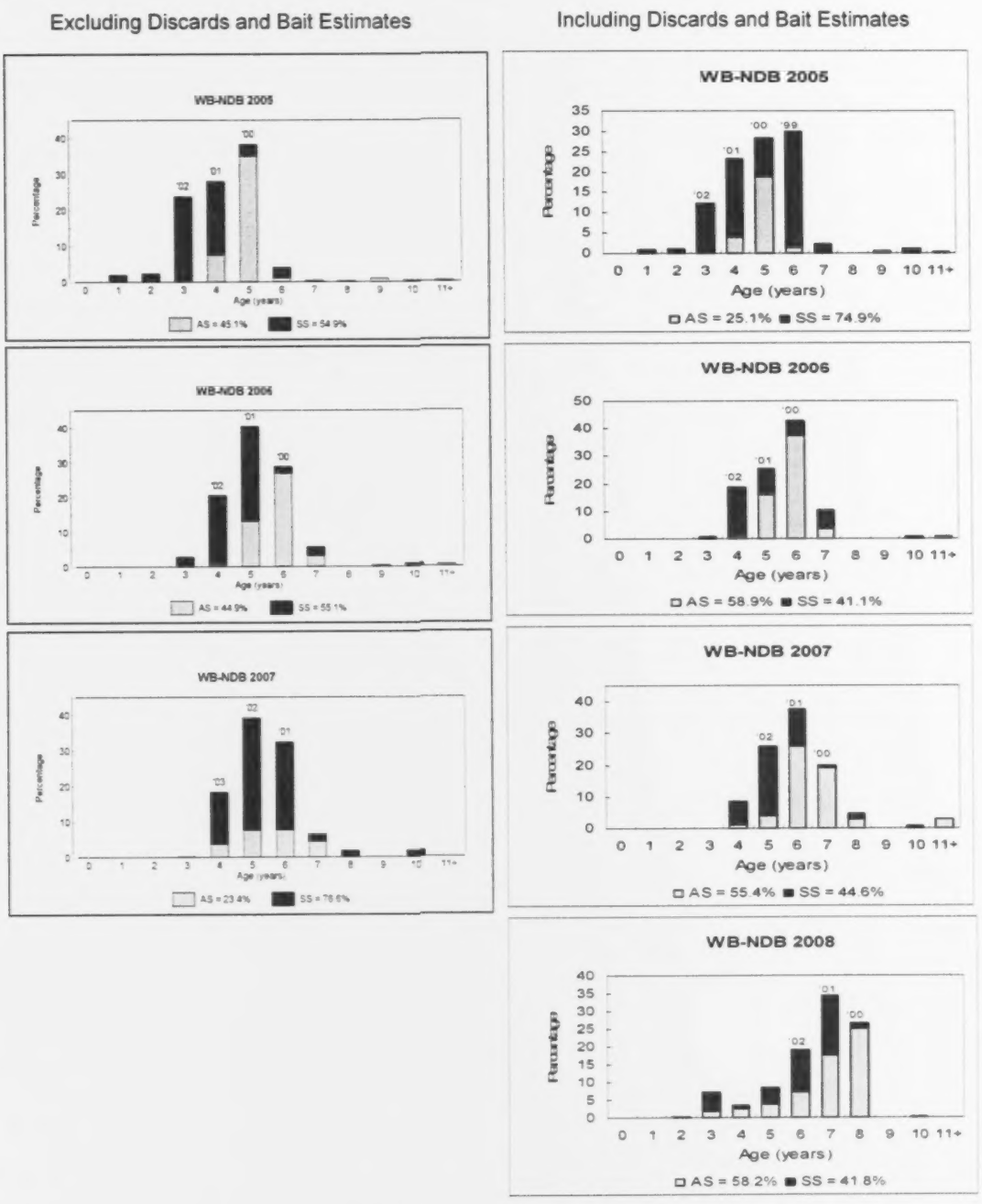


Figure 7. Age distribution of herring from the commercial fishery, by spawning type, White Bay–Notre Dame Bay, 2005-08. Left panels exclude estimates of herring discards and herring used as bait; right panels include estimates of herring discards and herring used as bait.

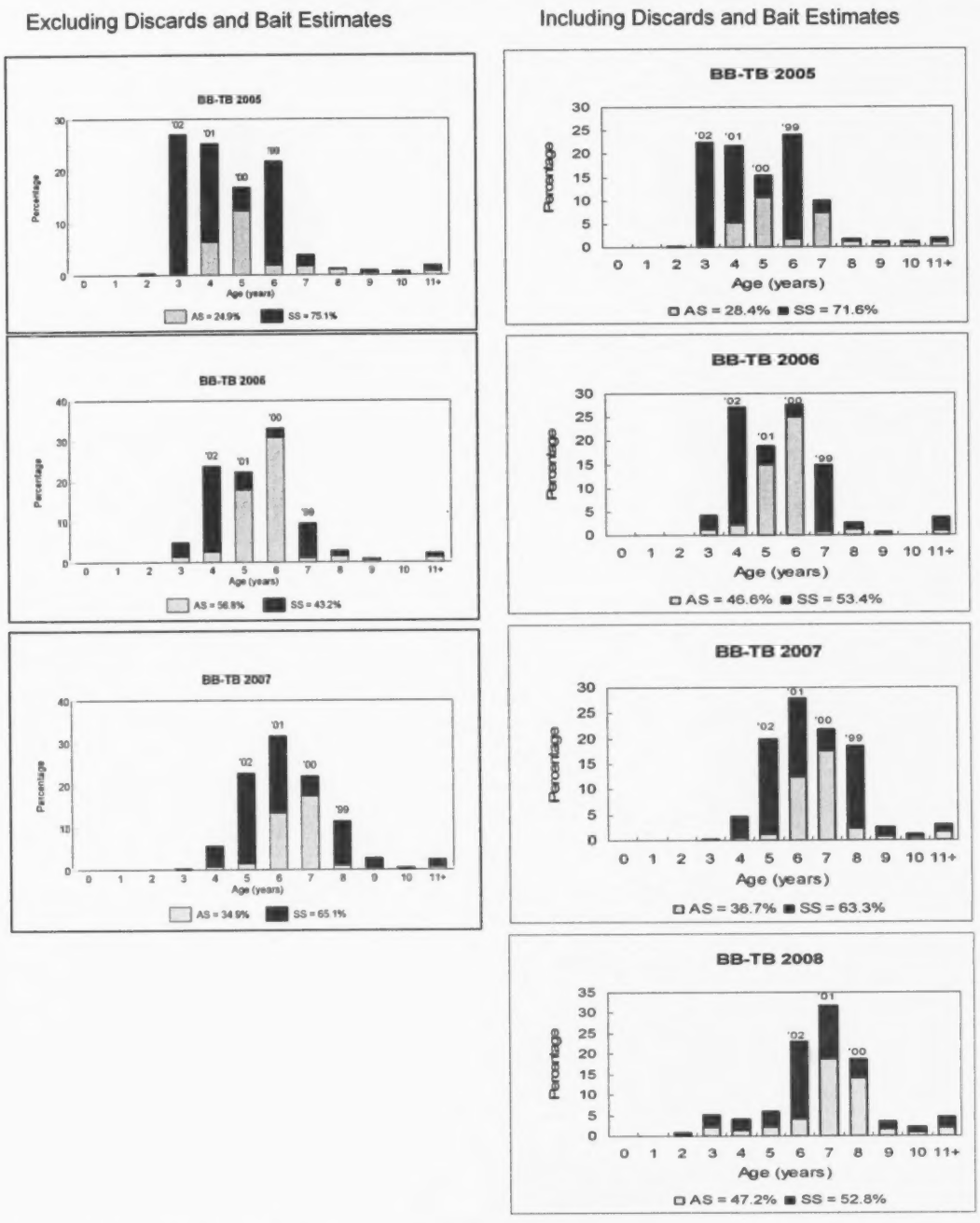


Figure 8. Age distribution of herring from the commercial fishery, by spawning type, Bonavista Bay-Trinity Bay, 2005 to 2008. Left panels exclude estimates of herring discards and herring used as bait; right panels include estimates of herring discards and herring used as bait.

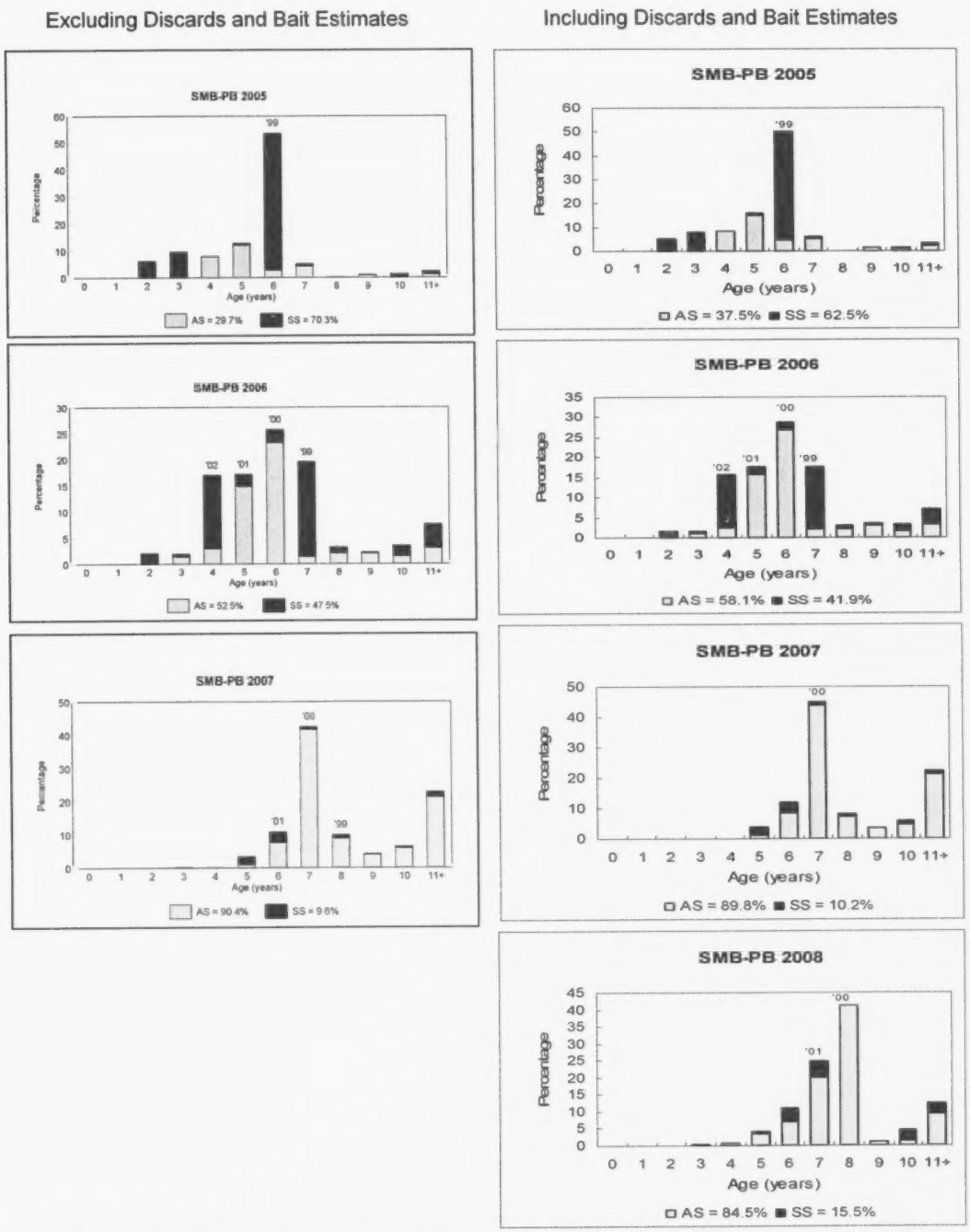


Figure 9. Age distribution of herring from the commercial fishery, by spawning type, St. Mary's Bay-Placentia Bay, 2005 to 2008. Left panels exclude estimates of herring discards and herring used as bait; right panels include estimates of herring discards and herring used as bait.

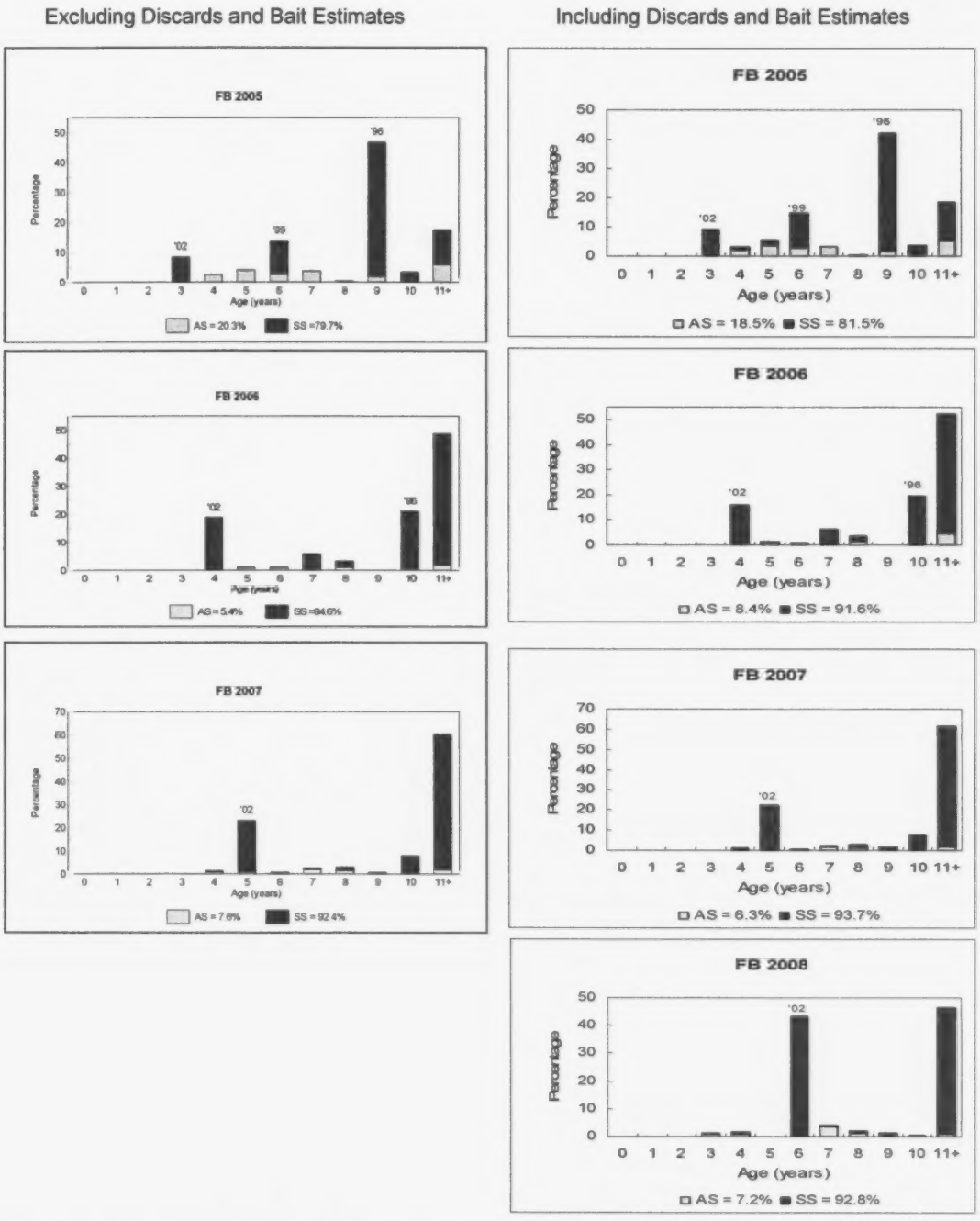


Figure 10. Age distribution of herring from the commercial fishery, by spawning type, Fortune Bay, 2005 to 2008. Left panels exclude estimates of herring discards and herring used as bait; right panels include estimates of herring discards and herring used as bait.

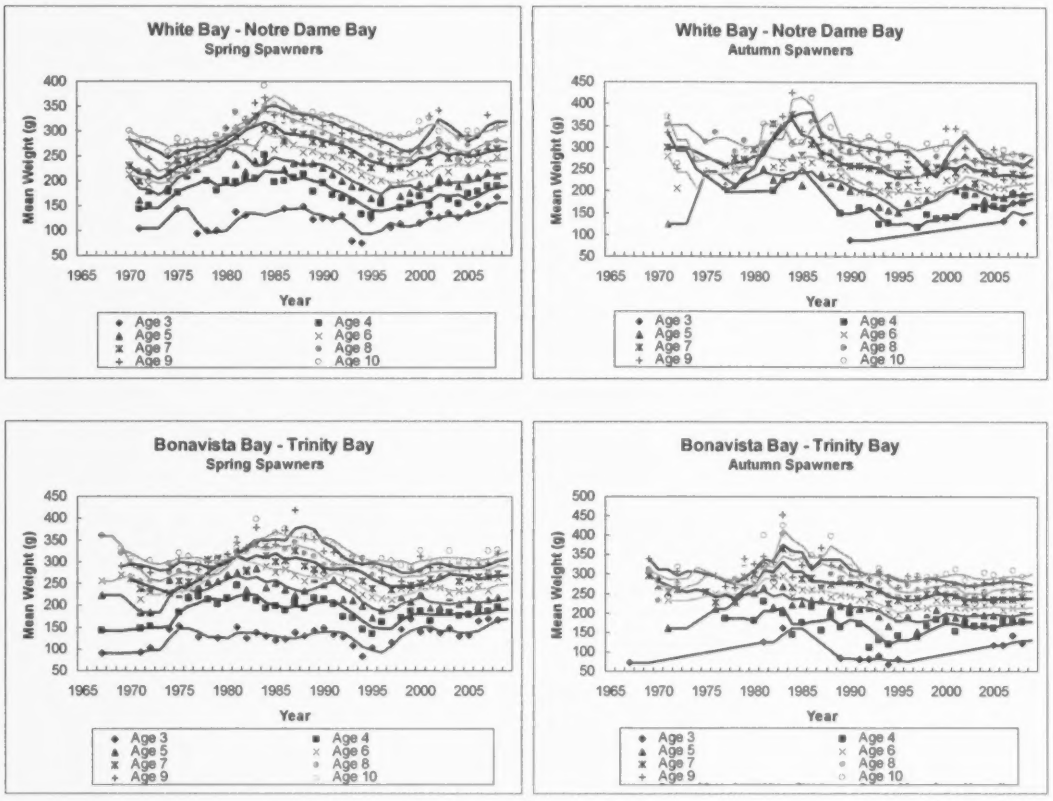


Figure 11. Mean weights-at-ages 3 to 10 (three year running average) of spring and autumn spawning herring, by stock area, from samples collected January to June, 1965–2008.

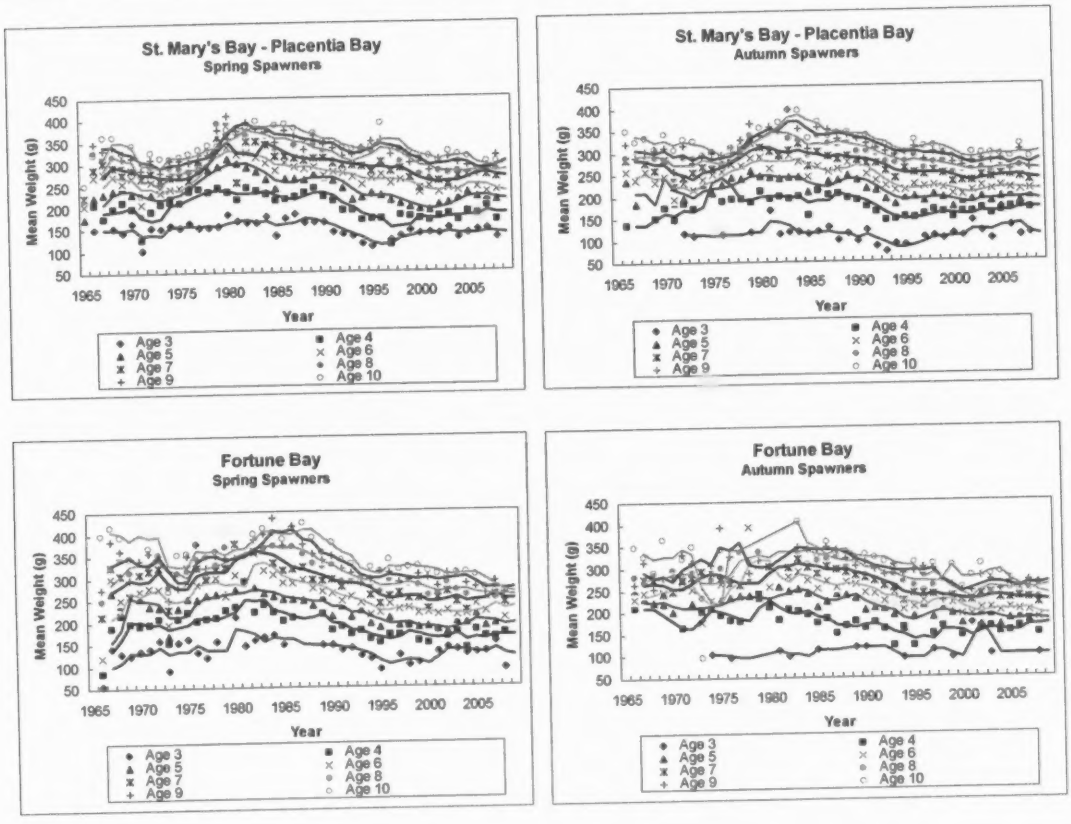


Figure 11. (Cont'd.)

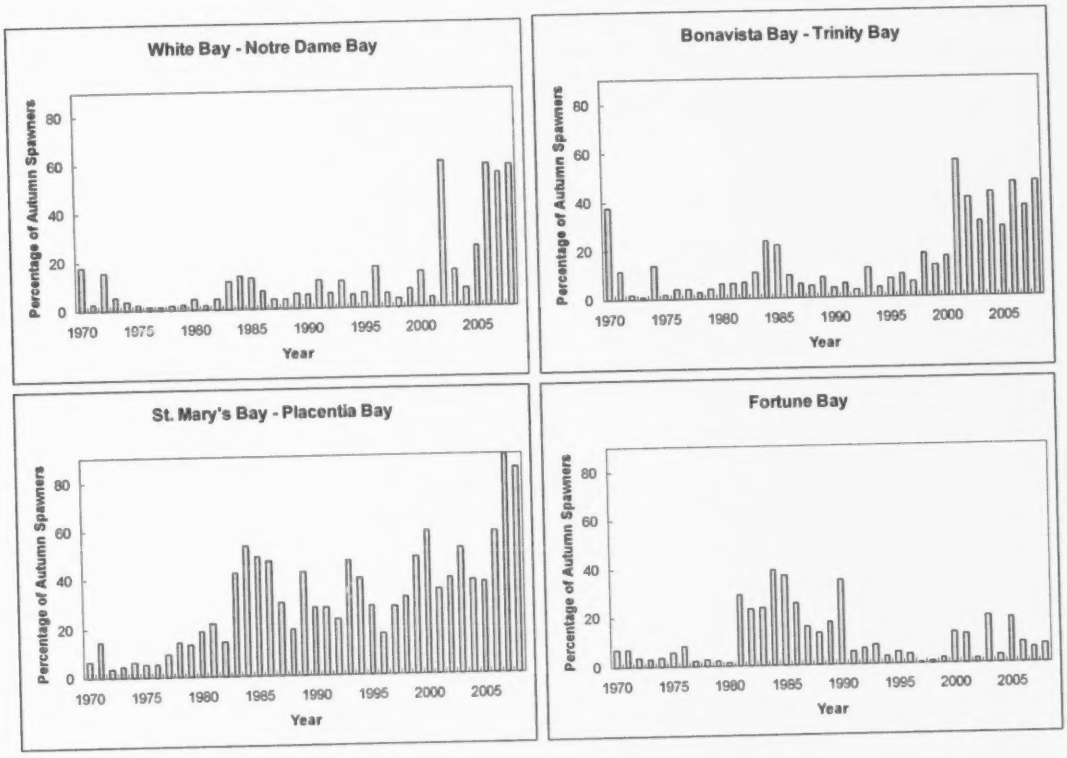


Figure 12. Percentage of autumn spawners in commercial catches, by stock area and year. Catches include herring discards and herring used as bait.

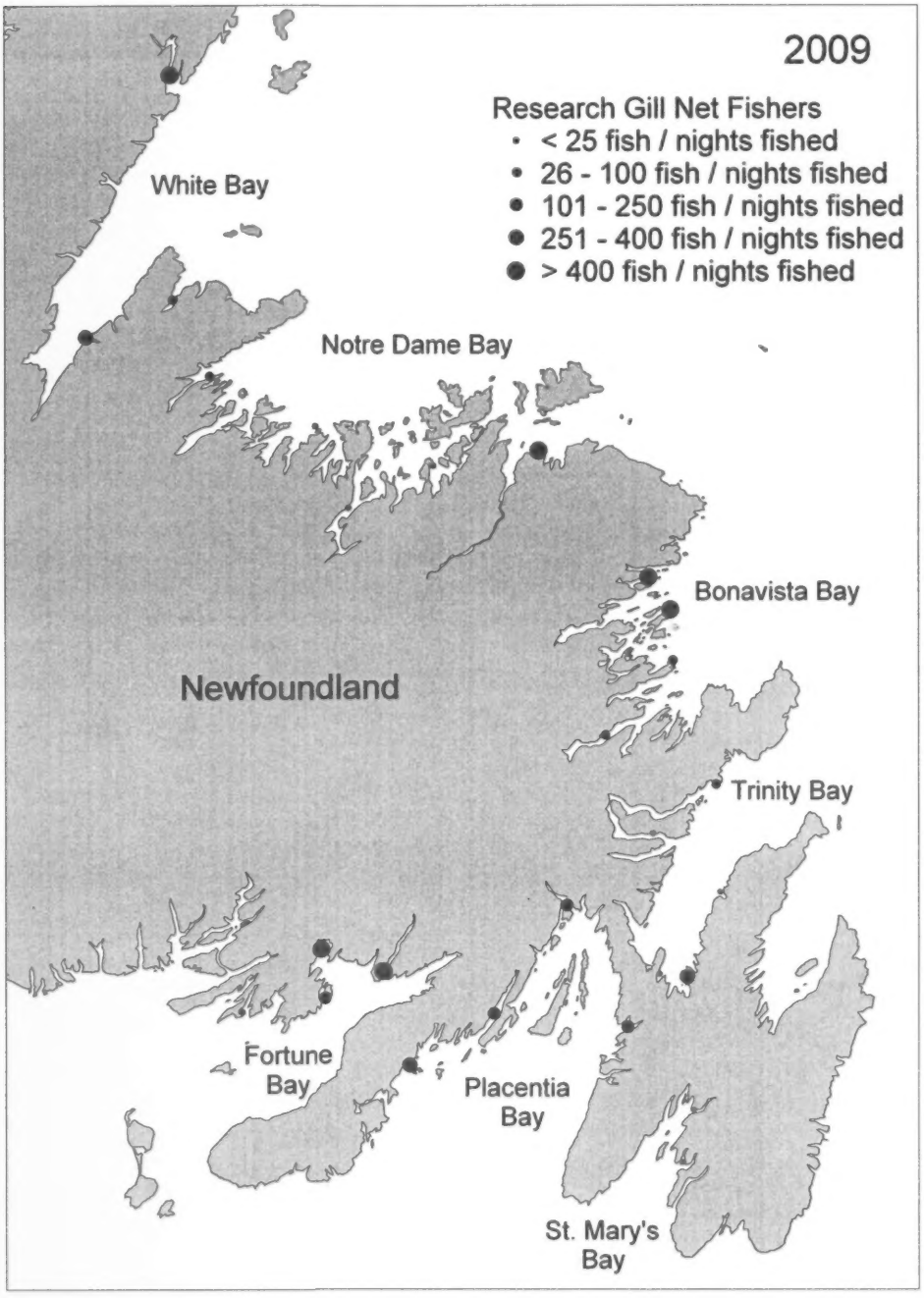


Figure 13. Herring research gill net locations, by stock area, in 2009.

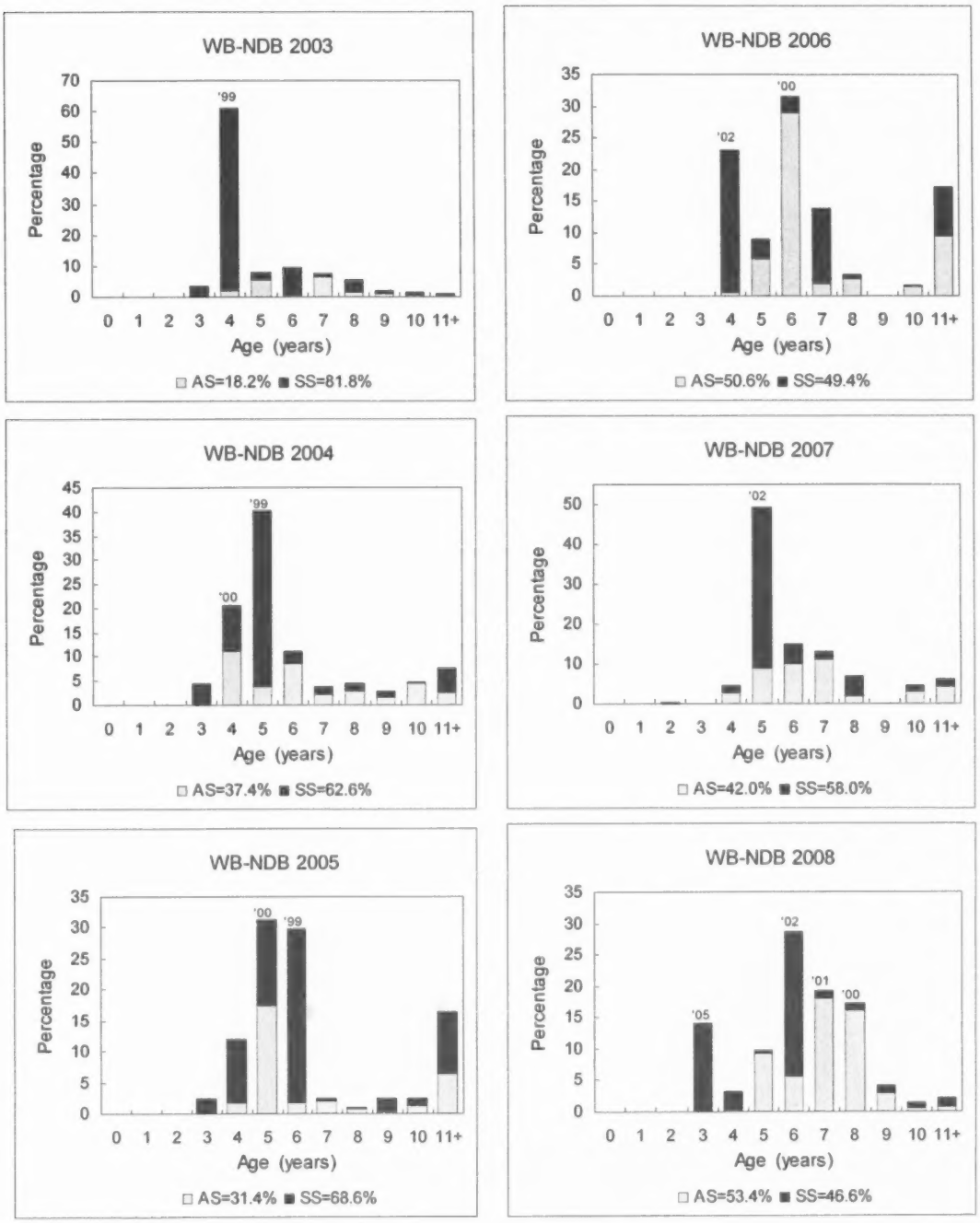


Figure 14. Age distribution of herring from the spring research gill net program, by spawning type, White Bay–Notre Dame Bay, 2003-08.

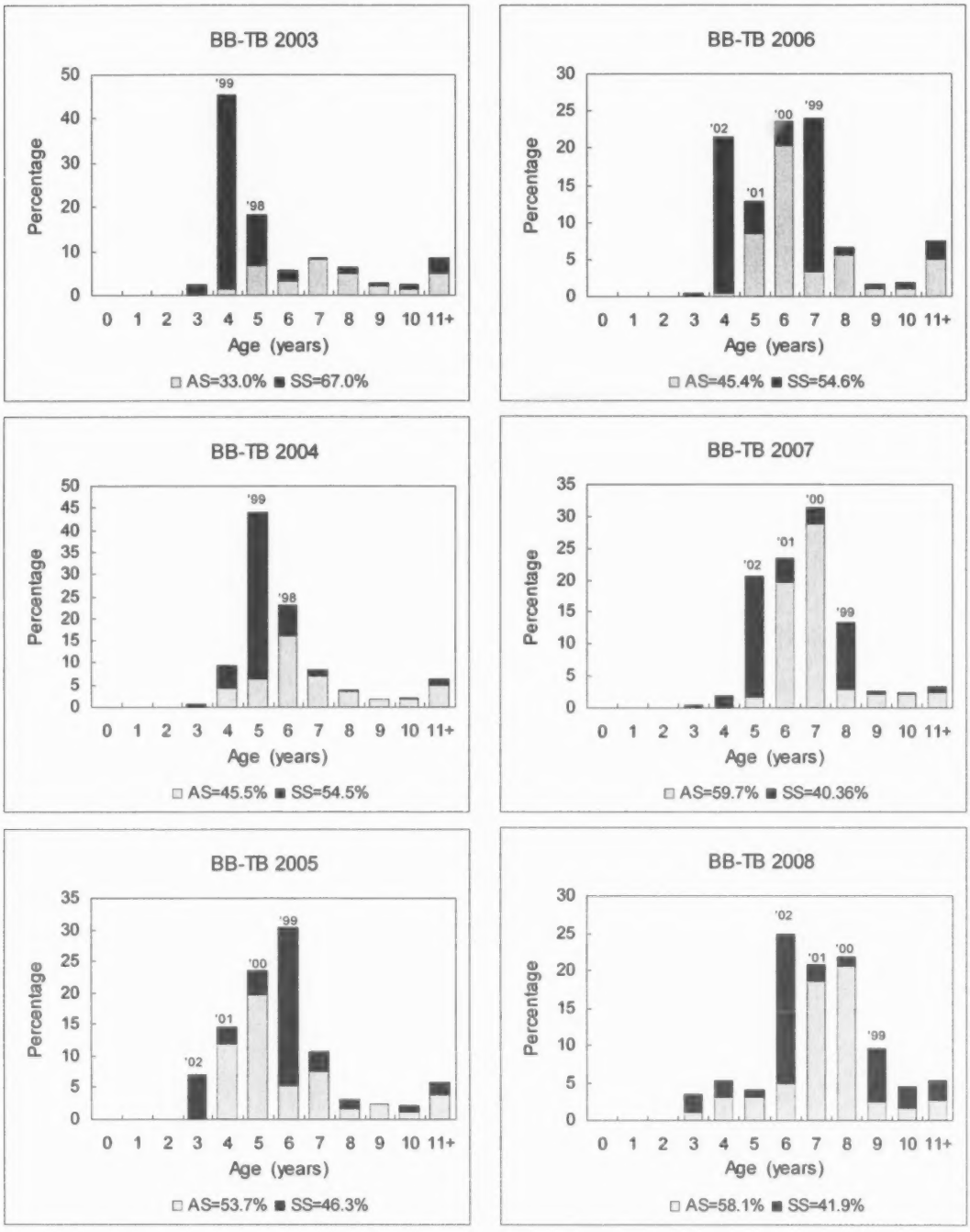


Figure 15. Age distribution of herring from the spring research gill net program, by spawning type, Bonavista Bay-Trinity Bay, 2003-2008.

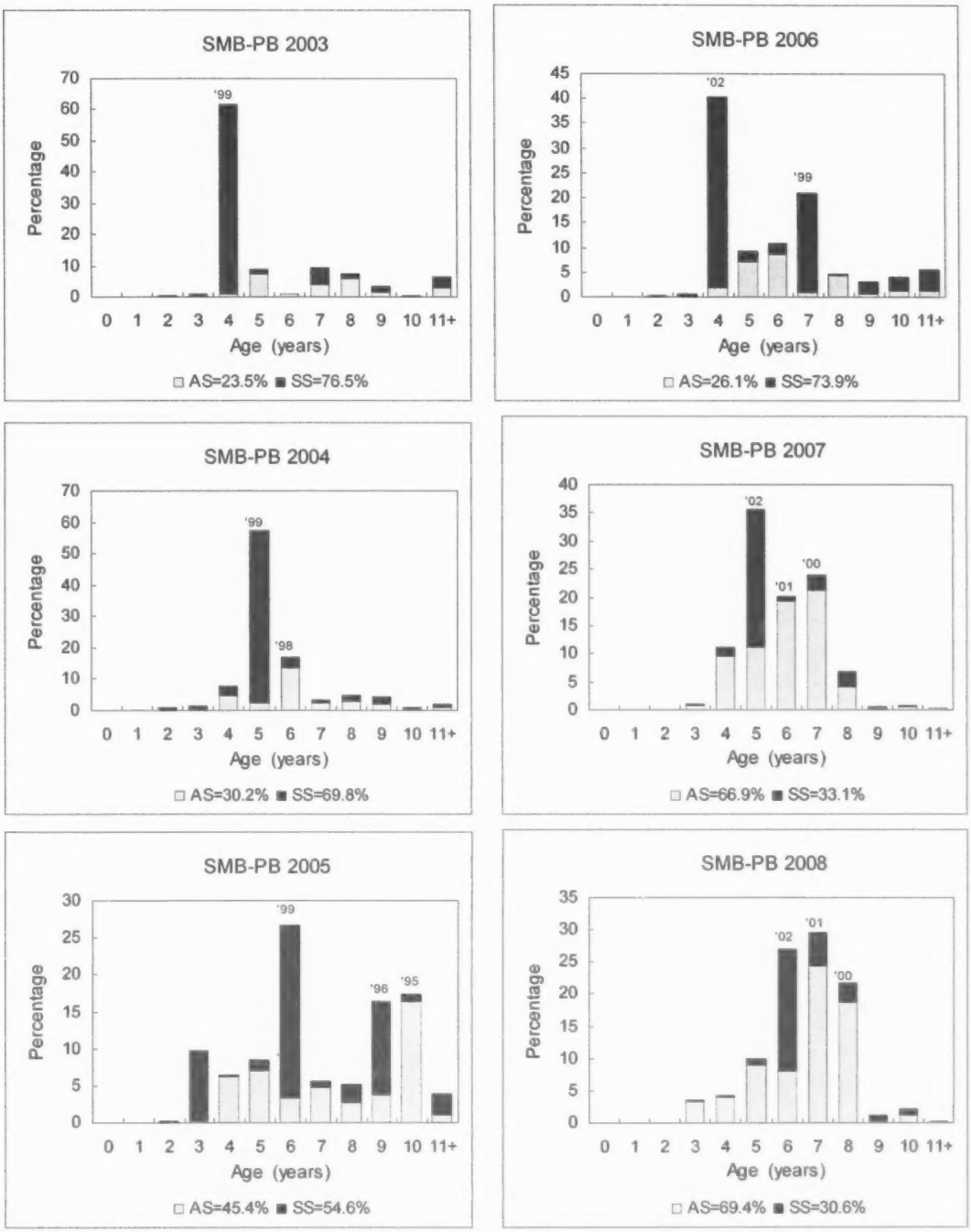


Figure 16. Age distribution of herring from the spring research gill net program, by spawning type, St. Mary's Bay–Placentia Bay, 2003-08.

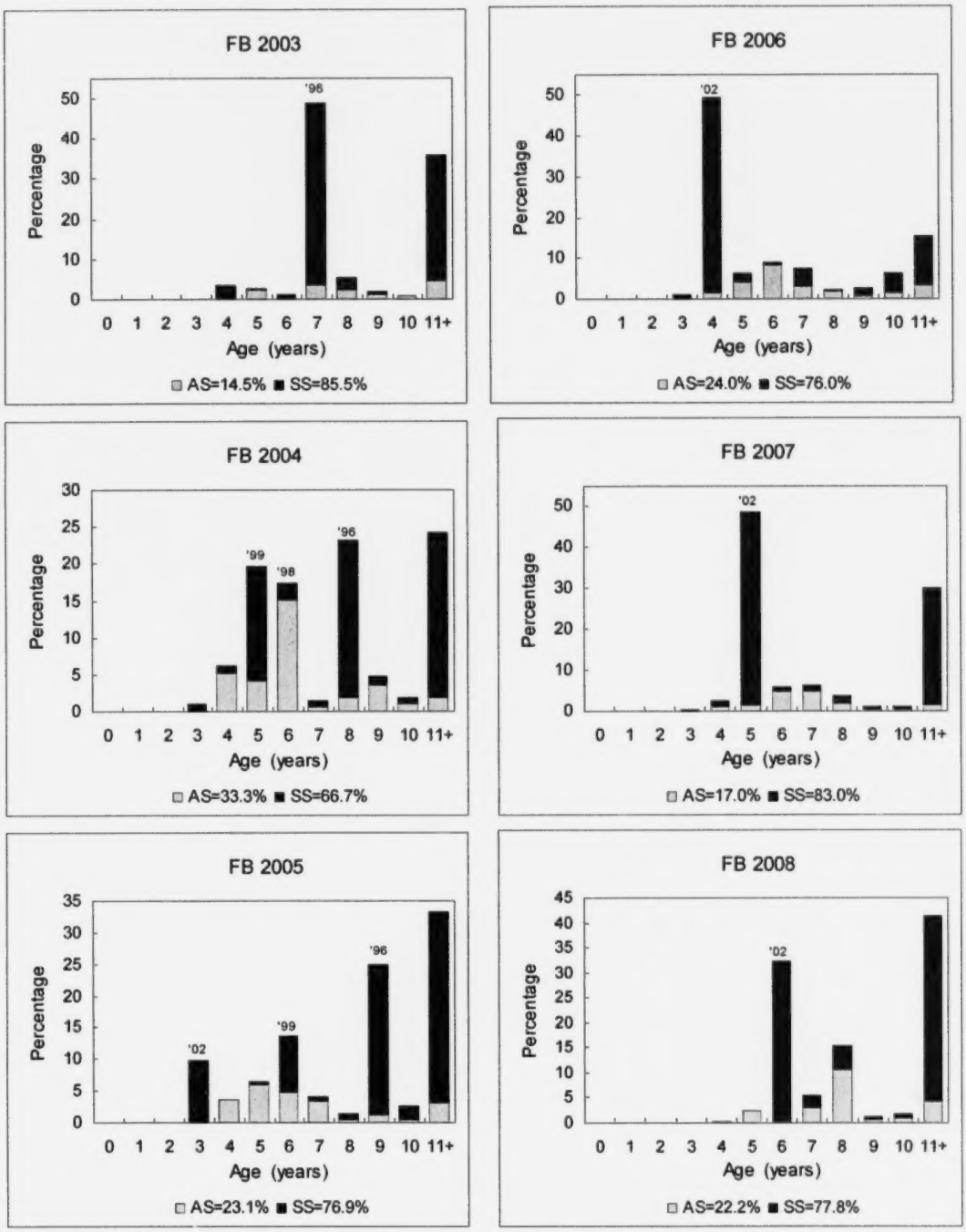


Figure 17. Age distribution of herring from the spring research gill net program, by spawning type, Fortune Bay, 2003-08.

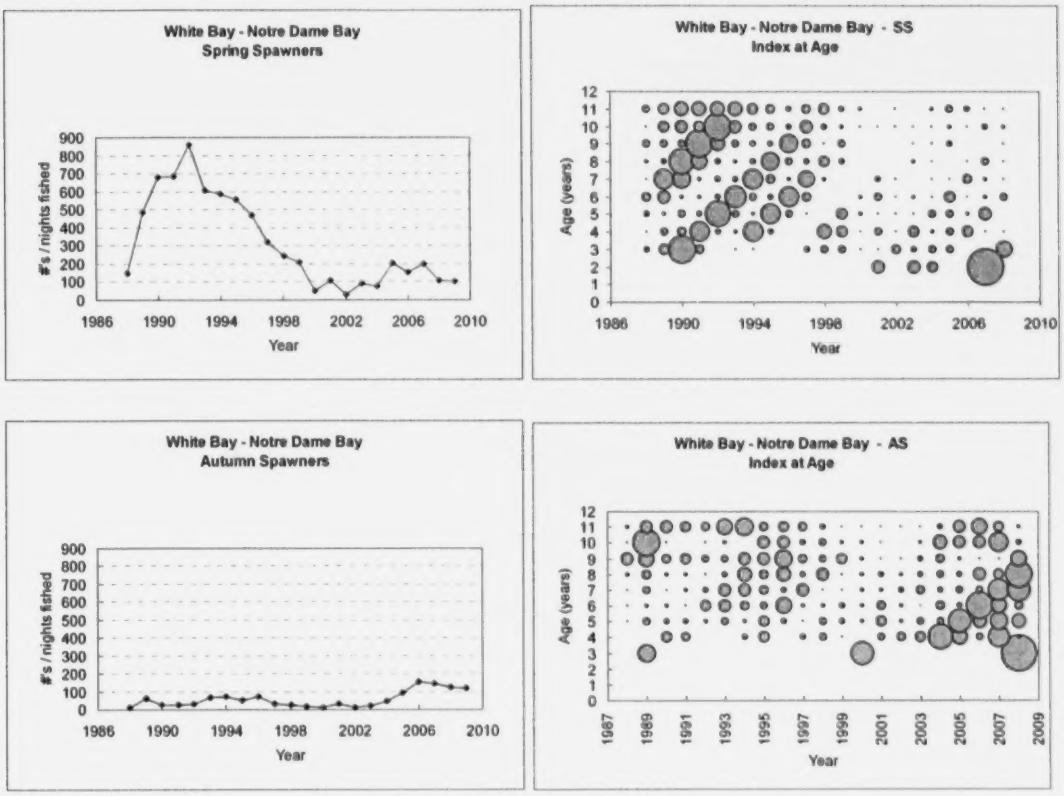


Figure 18. Research gill net catch rates (numbers per nights fished) and indices at age (normalized by age) for White Bay–Notre Dame Bay, by spawning type, 1988-2008.

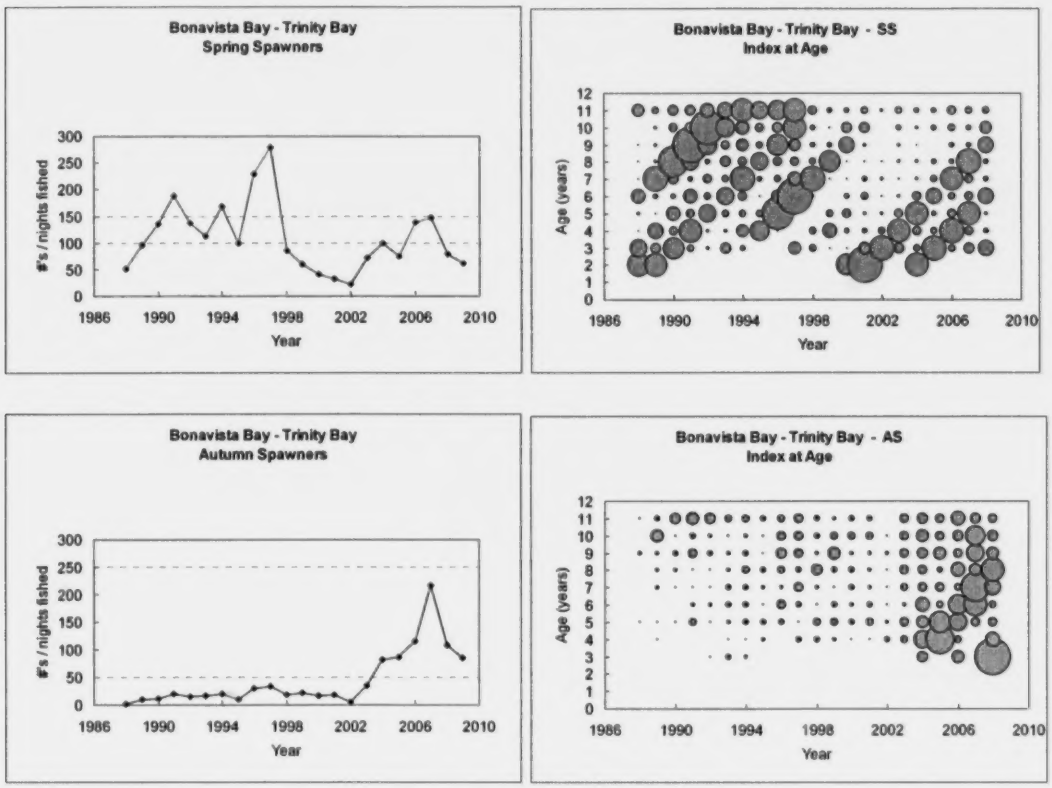


Figure 19. Research gill net catch rates (numbers per nights fished) and indices at age (normalized by age) for Bonavista Bay-Trinity Bay, by spawning type, 1988-2008.

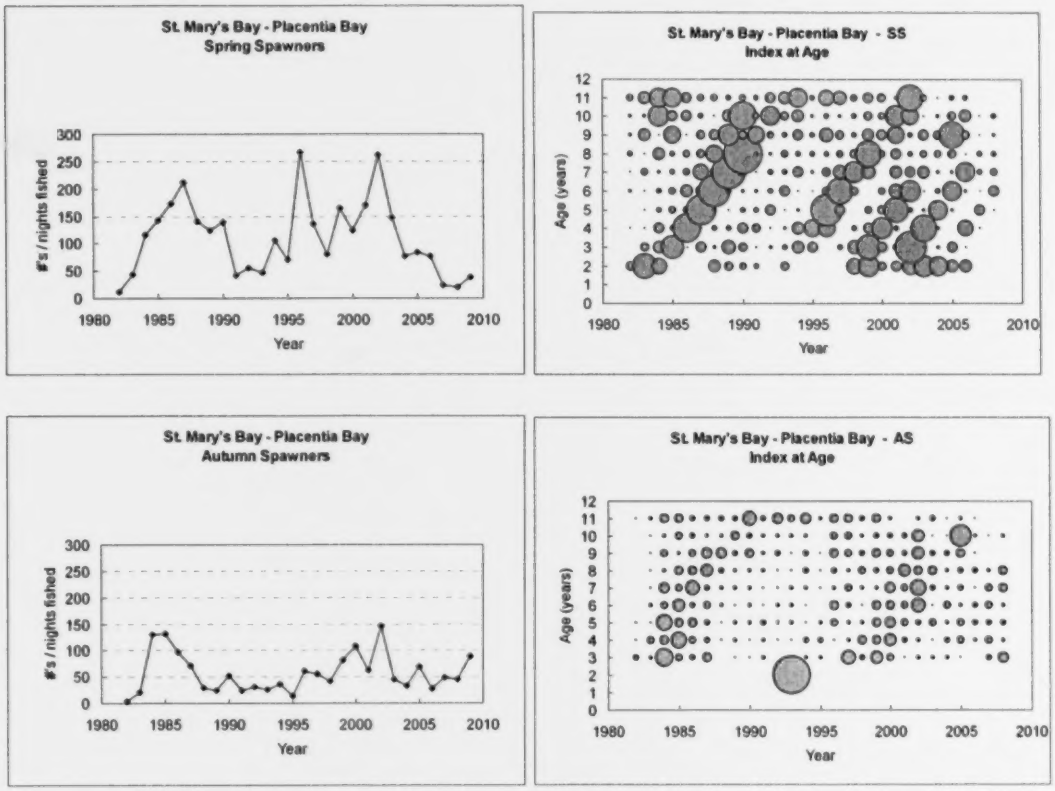


Figure 20. Research gill net catch rates (numbers per nights fished) and indices at age (normalized by age) for St. Mary's Bay–Placentia Bay, by spawning type, 1982-2008.

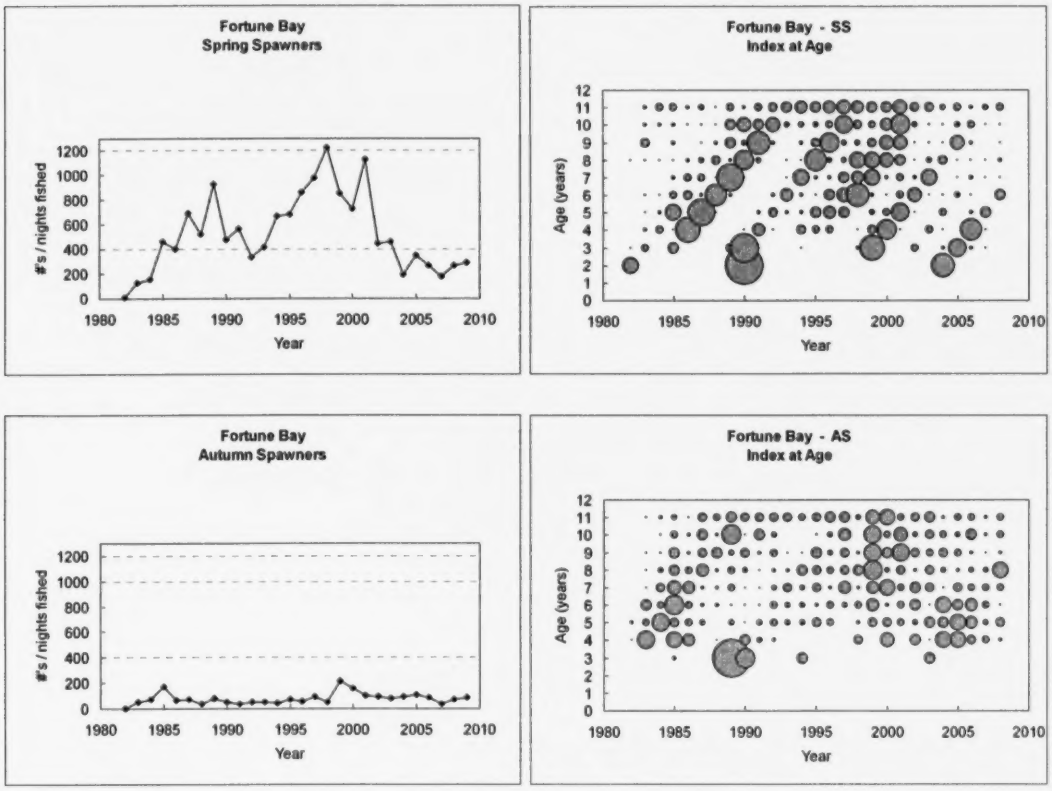


Figure 21. Research gill net catch rates (numbers per nights fished) and indices at age (normalized by age) for Fortune Bay, by spawning type, 1982-2008.

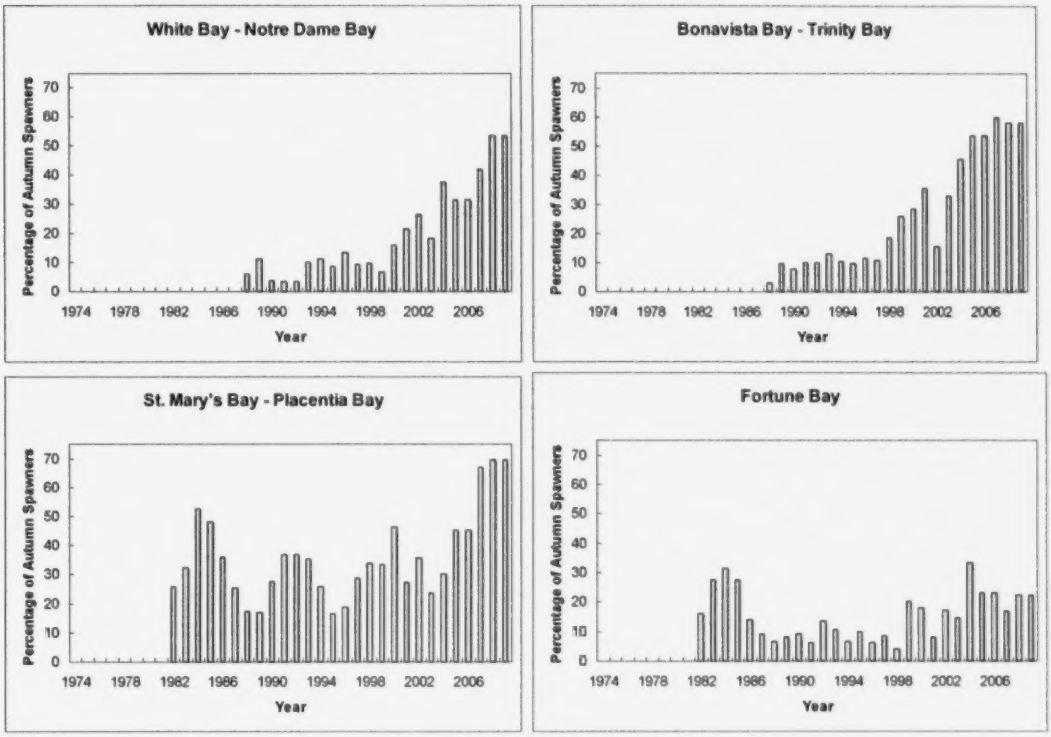


Figure 22. Percentage of autumn spawners in research gill net catches, by stock area and year.

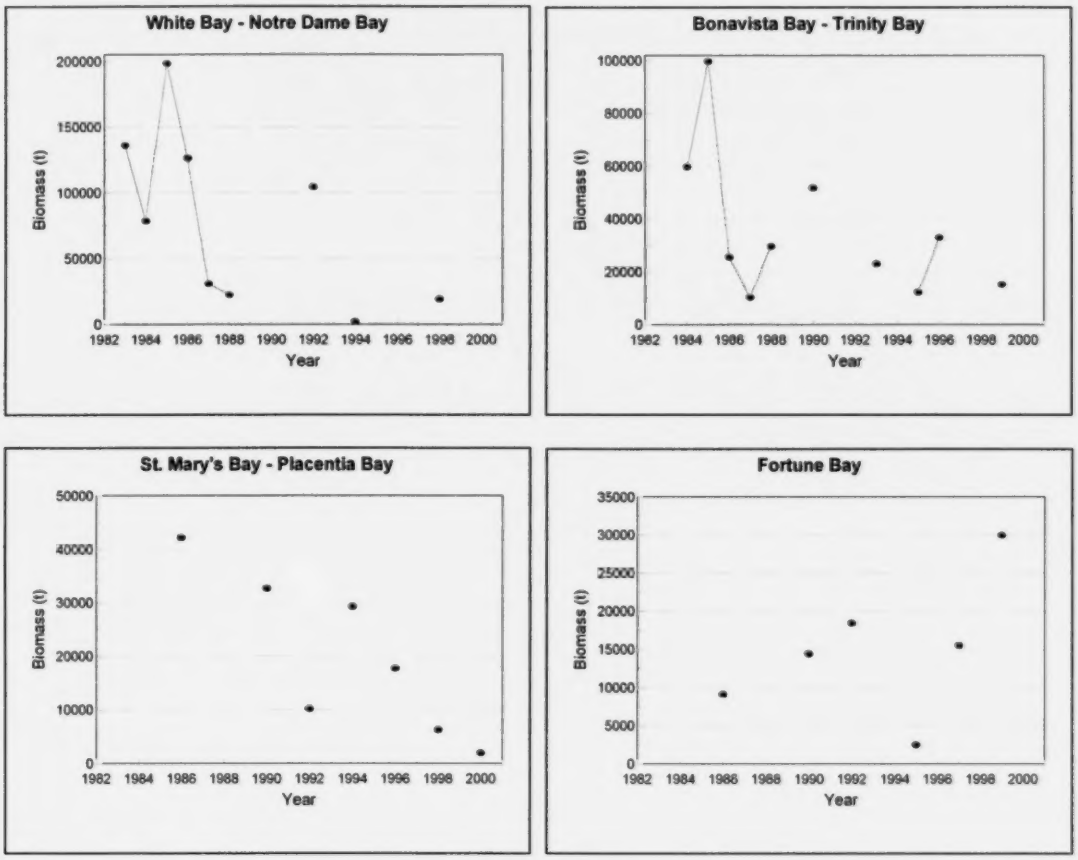


Figure 23. Acoustic survey biomass estimates (tonnes), by stock area, 1983-2000.

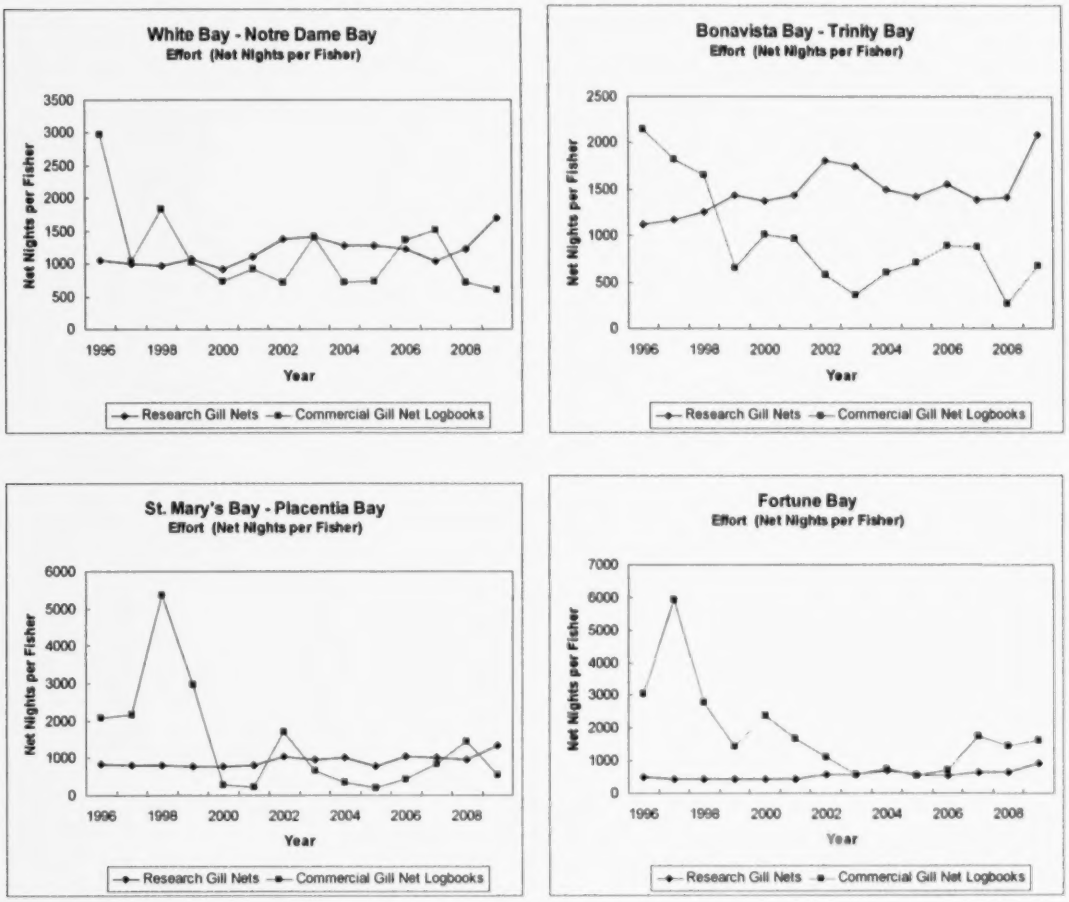


Figure 24. Comparison of total effort (net nights per fisher) for research gill net and commercial gill net logbook data, by stock area and year.

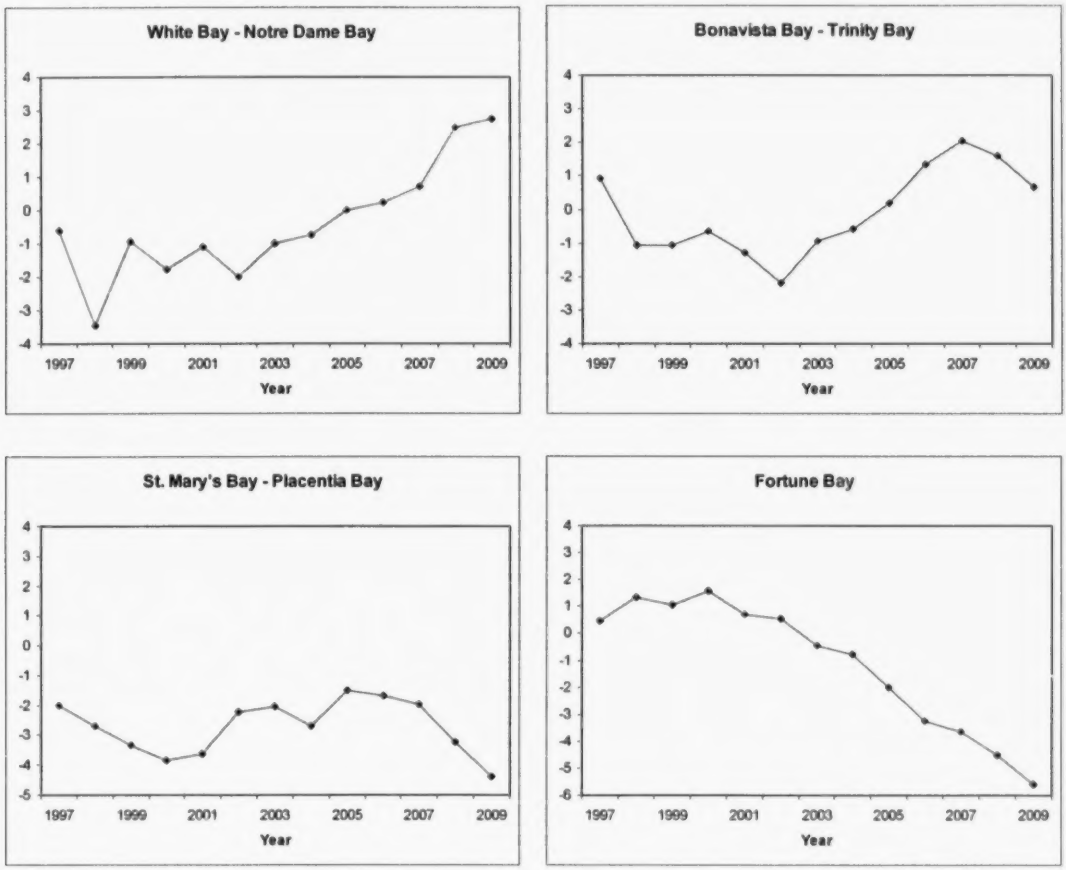


Figure 25. Cumulative abundance indices from commercial gill net logbooks, by stock area and year, where zero is considered to be average abundance.

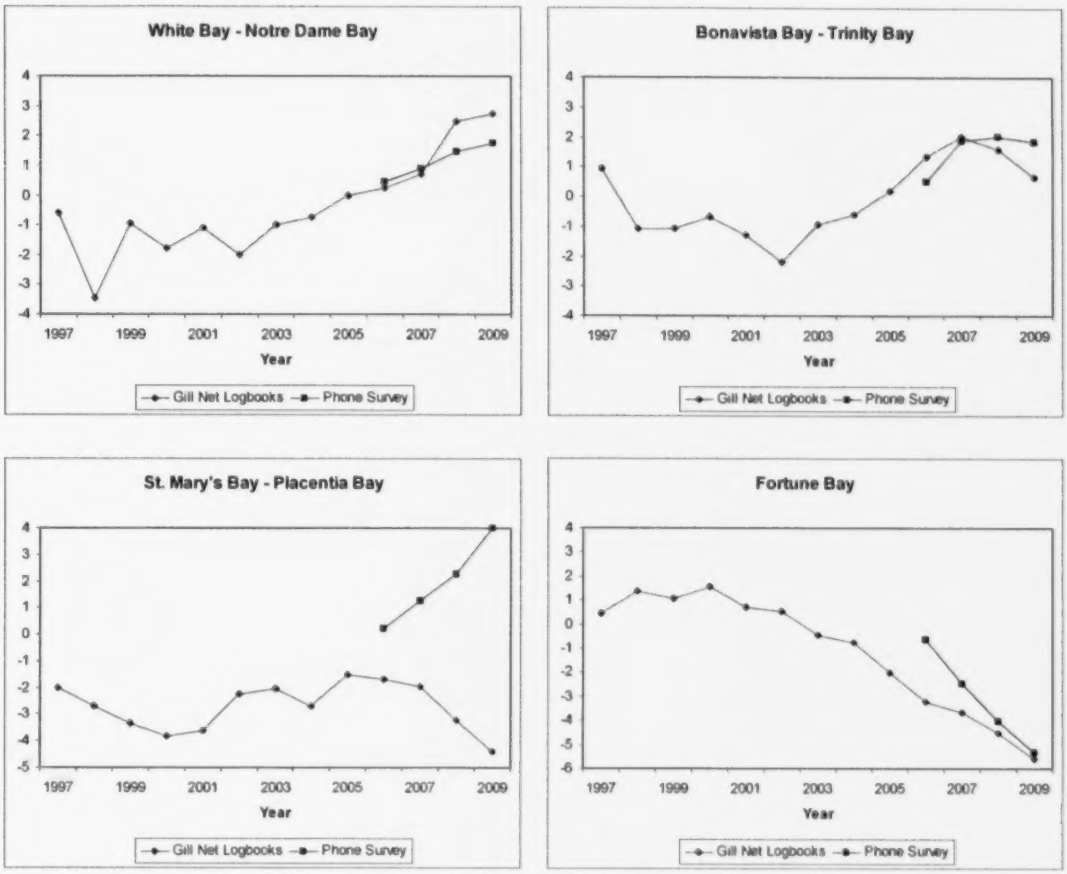


Figure 26. Cumulative abundance indices from gill net fisher telephone surveys compared to similar indices from commercial gill net logbooks. Zero is considered to be average abundance.

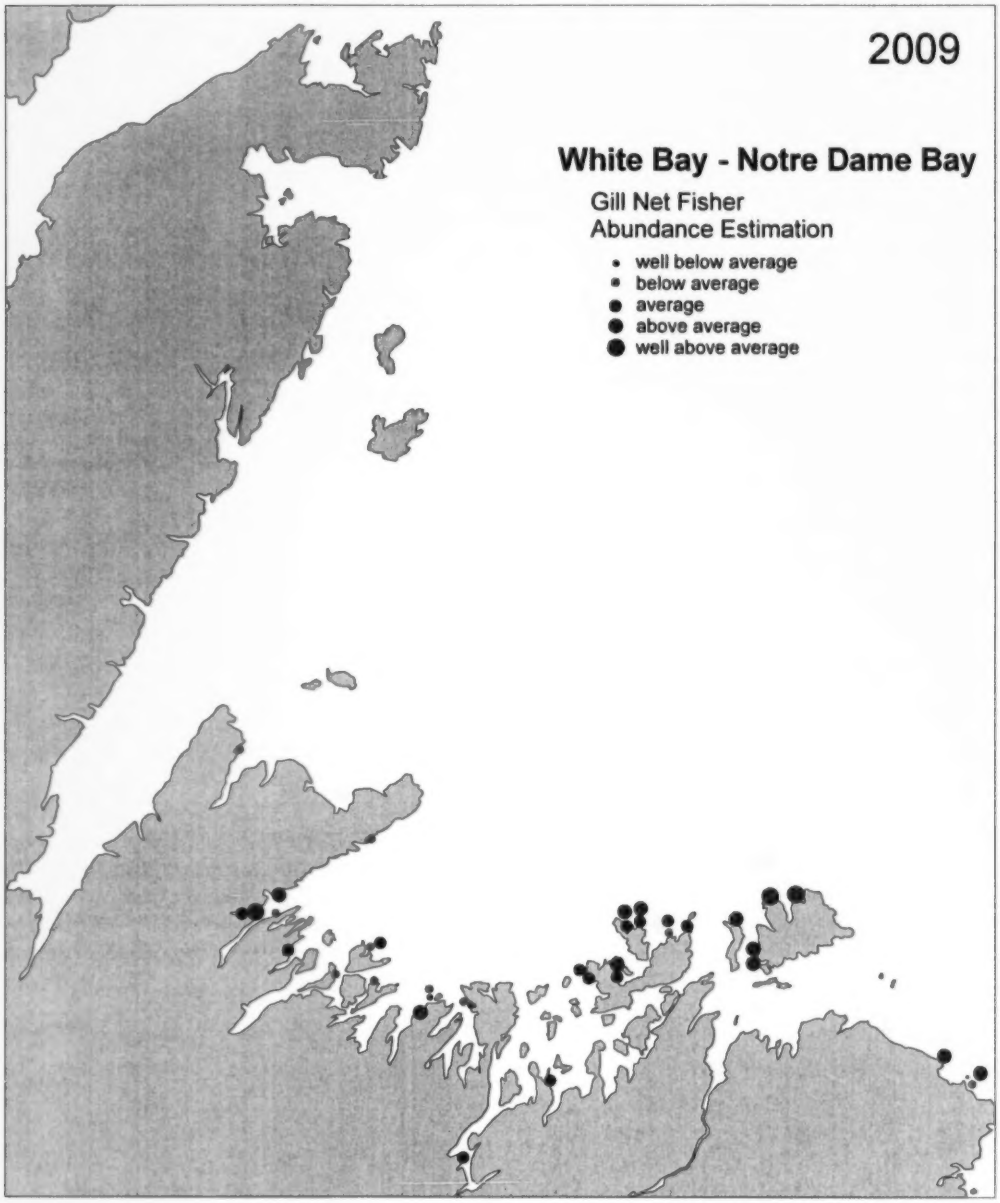


Figure 27. White Bay–Notre Dame Bay bait and commercial gill net set locations and abundance estimation from 2009 telephone survey.

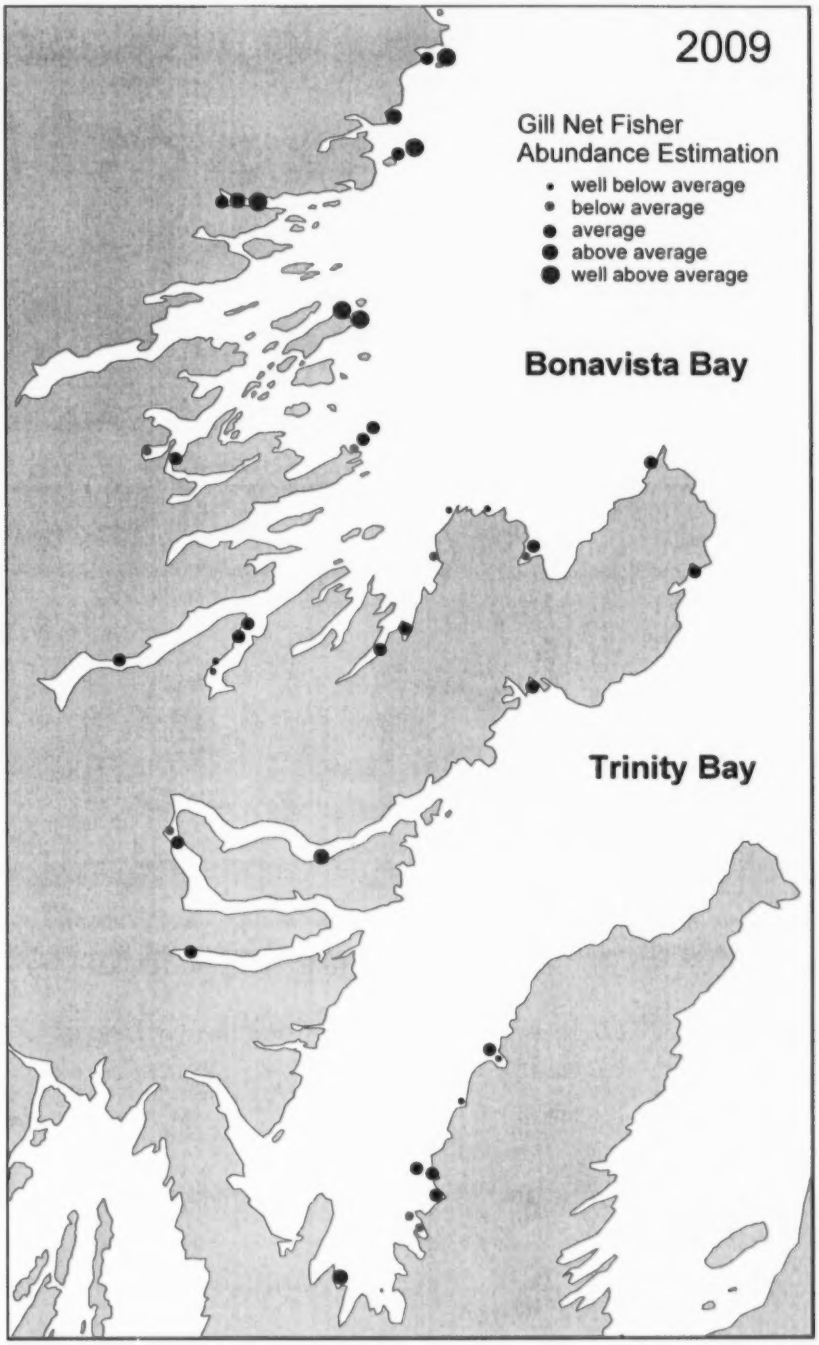


Figure 28. Bonavista Bay–Trinity Bay bait and commercial gill net set locations and abundance estimation from 2009 telephone survey.

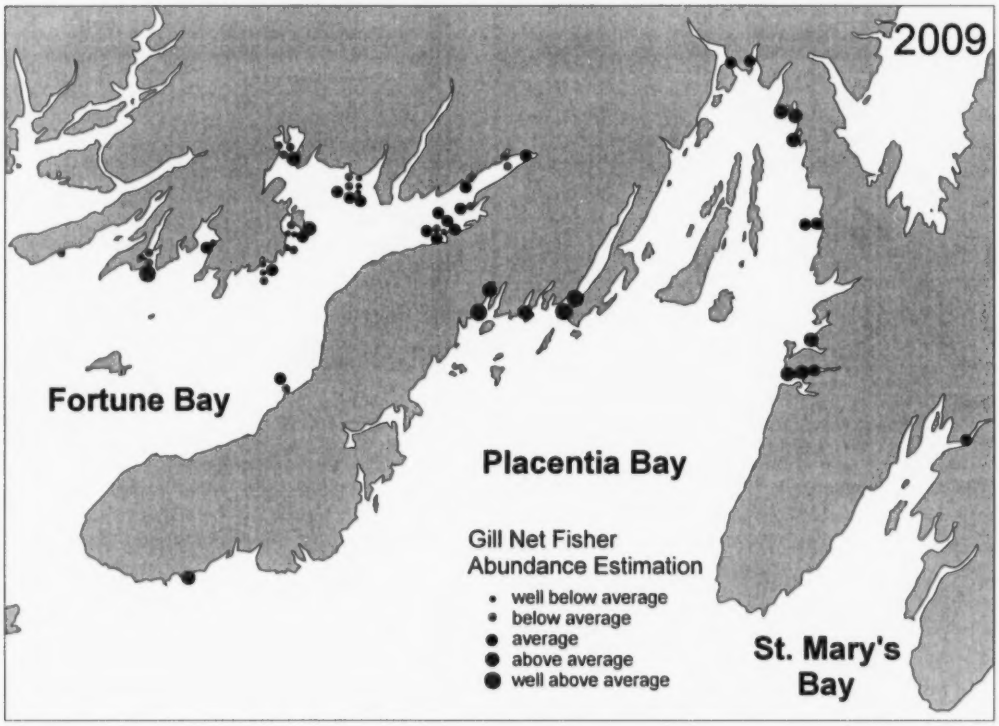


Figure 29. St. Mary's Bay–Placentia Bay and Fortune Bay bait and commercial gill net set locations and abundance estimation from 2009 telephone survey.

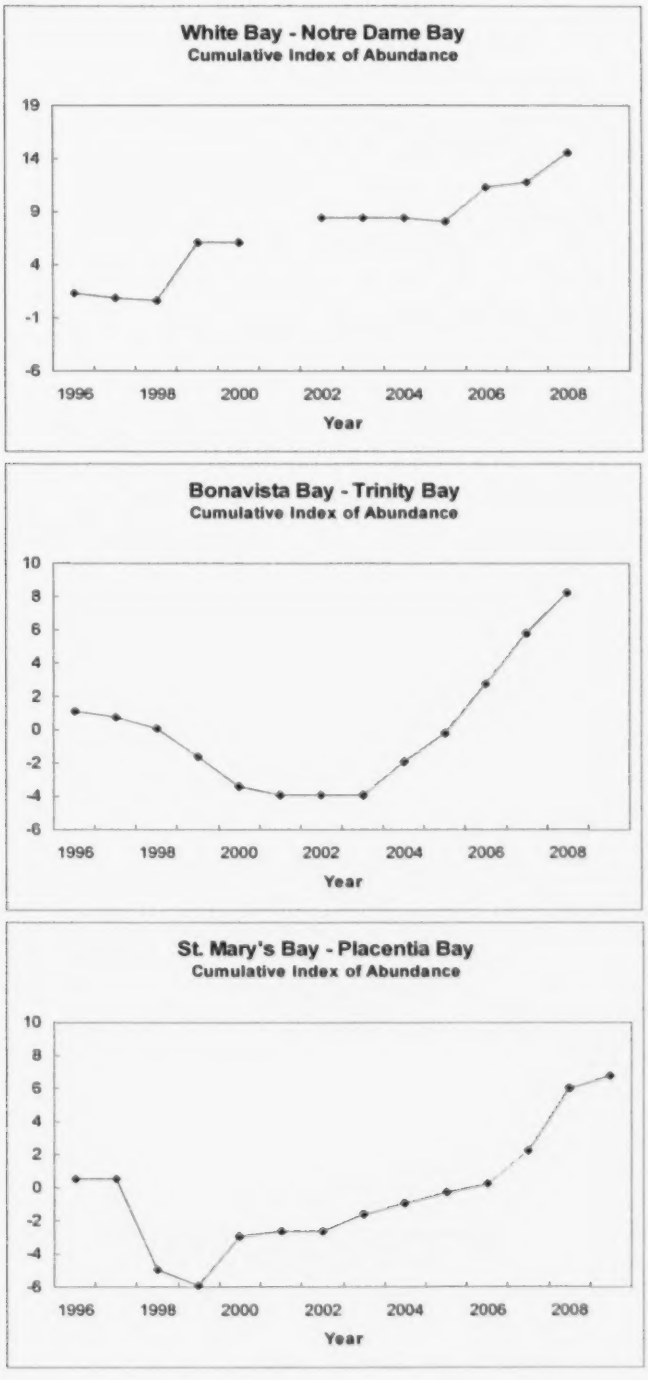


Figure 30. Cumulative abundance indices from purse seine fisher questionnaires, by stock area and year.

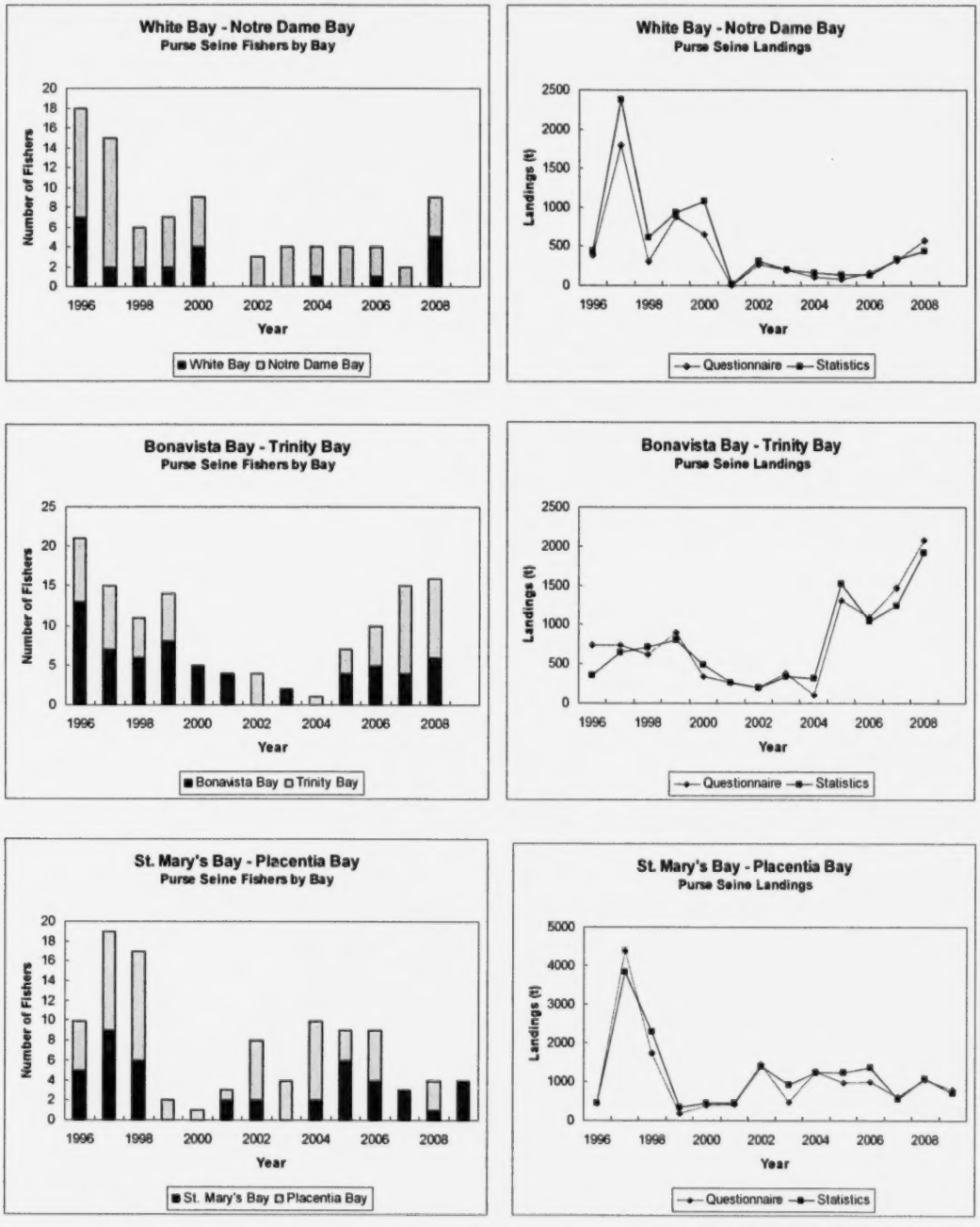


Figure 31. Left panels are the numbers of purse seine fishers who participated in the commercial fishery, by bay, by year, and by stock area. Right panels are the commercial purse seine landings, derived from the purse seine telephone survey and from Policy and Economics Branch statistics.

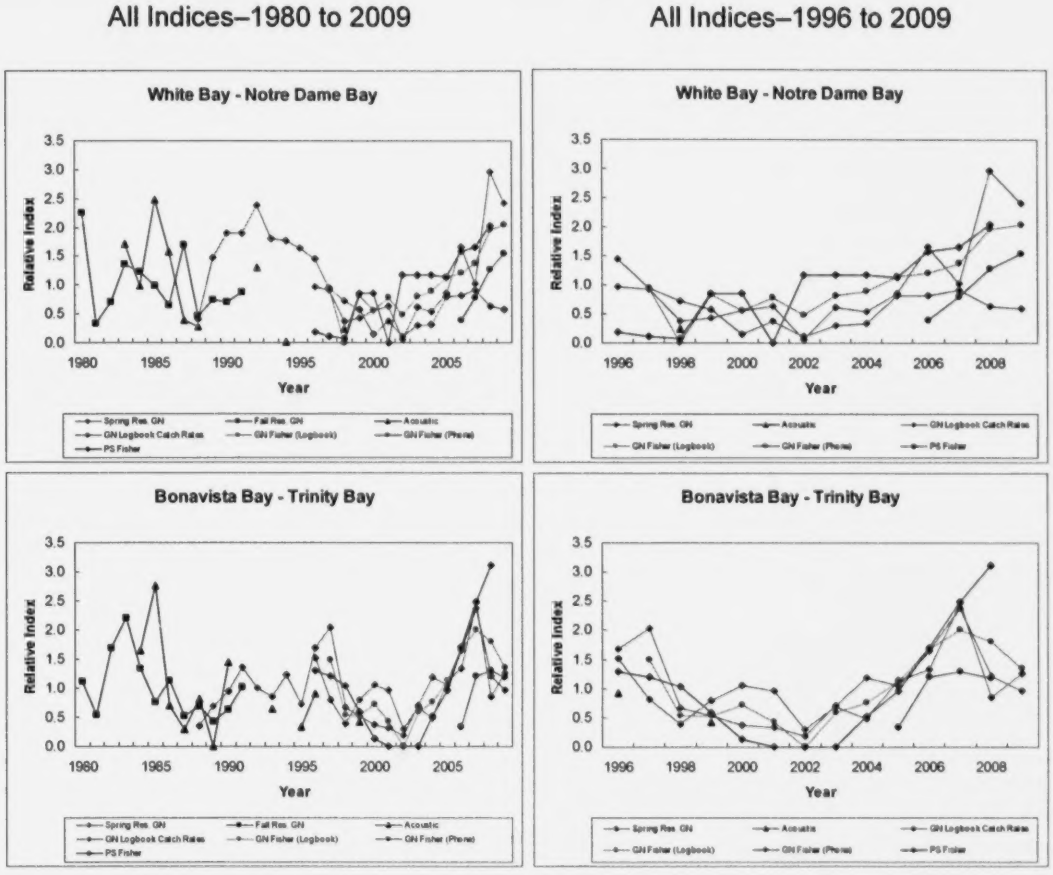
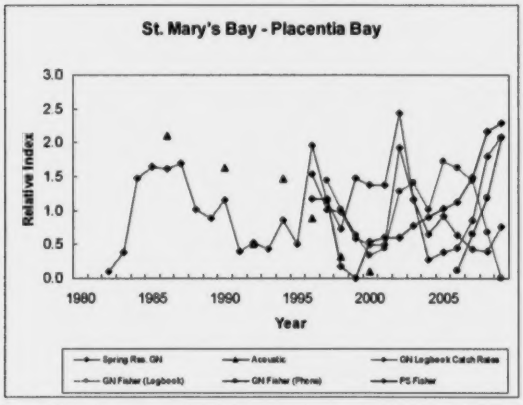
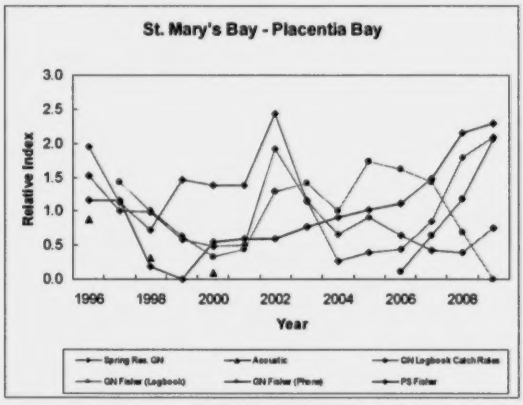


Figure 32. Comparison of all abundance indices, by stock area. Each index is standardized to its mean. Left panels include all indices for the period from 1980 to 2009; right panels show the same indices from 1996-2009.

All Indices–1980 to 2009



All Indices–1996 to 2009



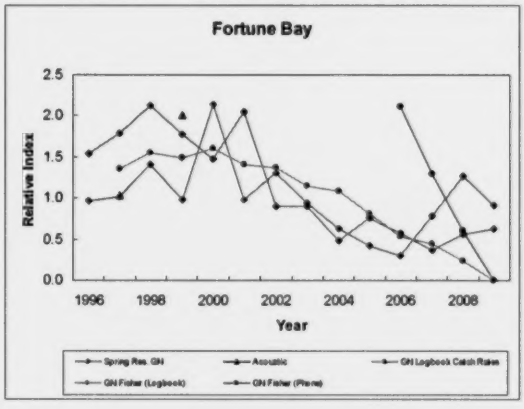


Figure 32 (Cont'd.).

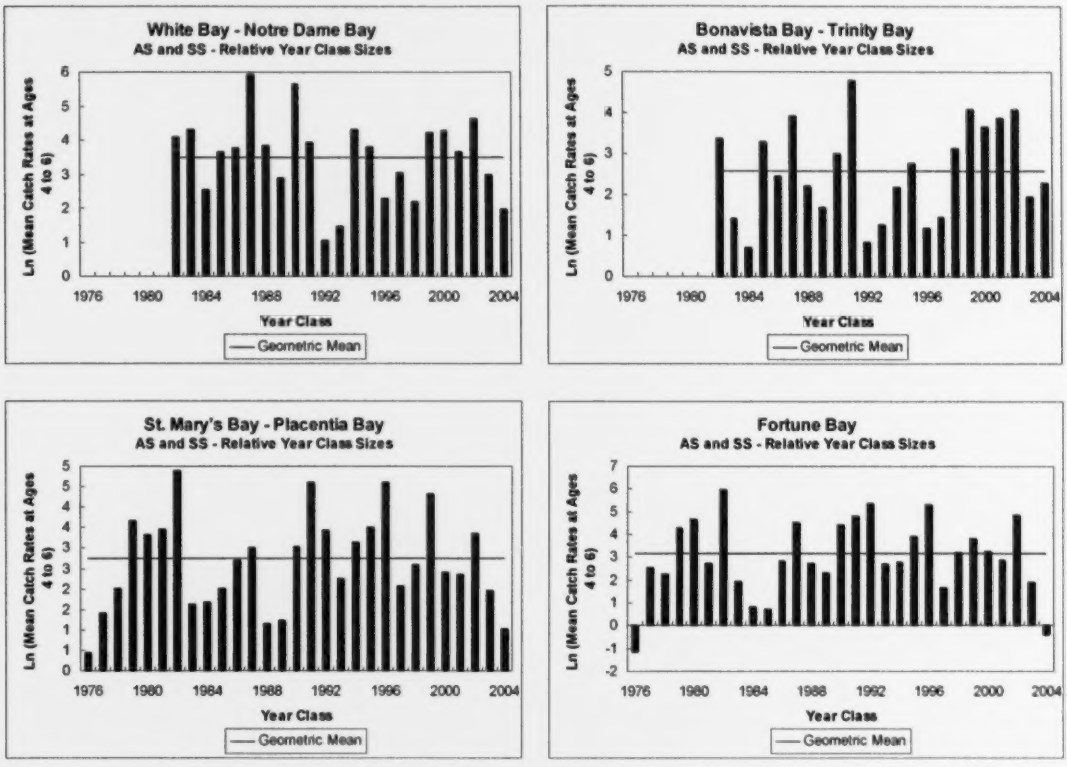

White Bay - Notre Dame Bay
AS and SS - Relative Year Class Sizes
Ln (Mean Catch Rates at Ages 4 to 6)
Year Class
Geometric Mean
Bonavista Bay - Trinity Bay
AS and SS - Relative Year Class Sizes
Ln (Mean Catch Rates at Ages 4 to 6)
Year Class
Geometric Mean
St. Mary's Bay - Placentia Bay
AS and SS - Relative Year Class Sizes
Ln (Mean Catch Rates at Ages 4 to 6)
Year Class
Geometric Mean
Fortune Bay
AS and SS - Relative Year Class Sizes
Ln (Mean Catch Rates at Ages 4 to 6)
Year Class
Geometric Mean

Figure 33. Relative year class sizes estimated from mean research gill net catch rates at ages 4, 5 and 6.

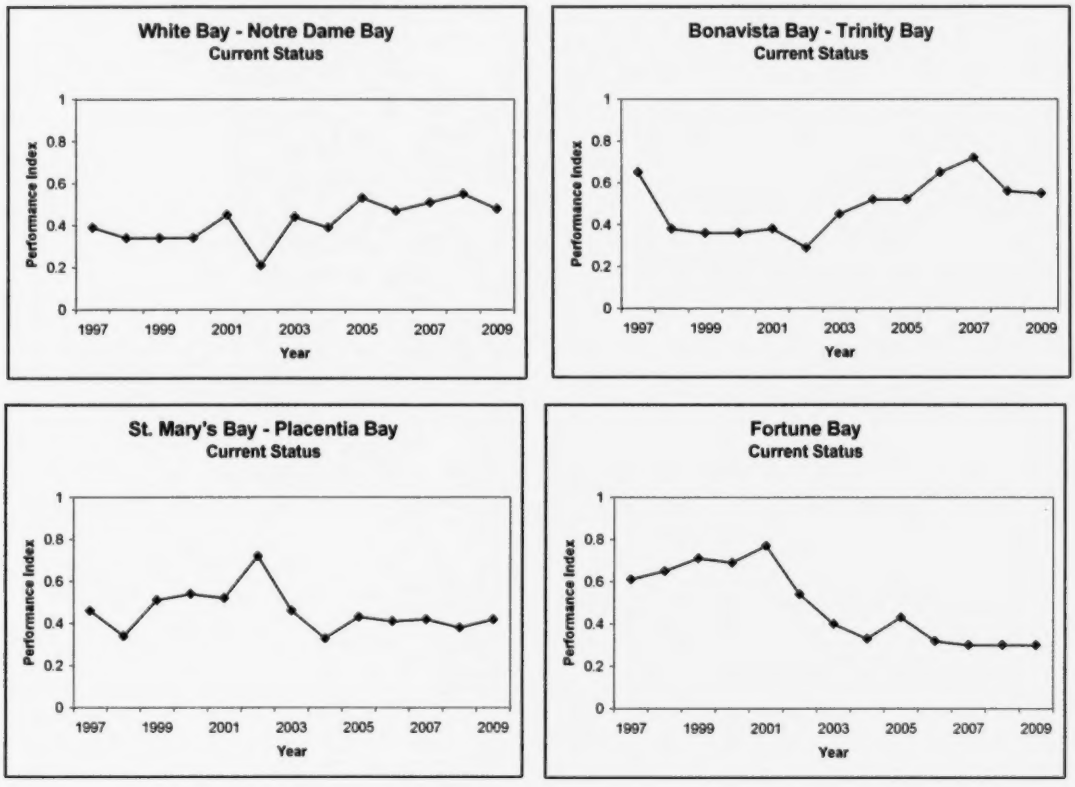


Figure 34. Performance report indices of current status, by stock area, 1997–2009.

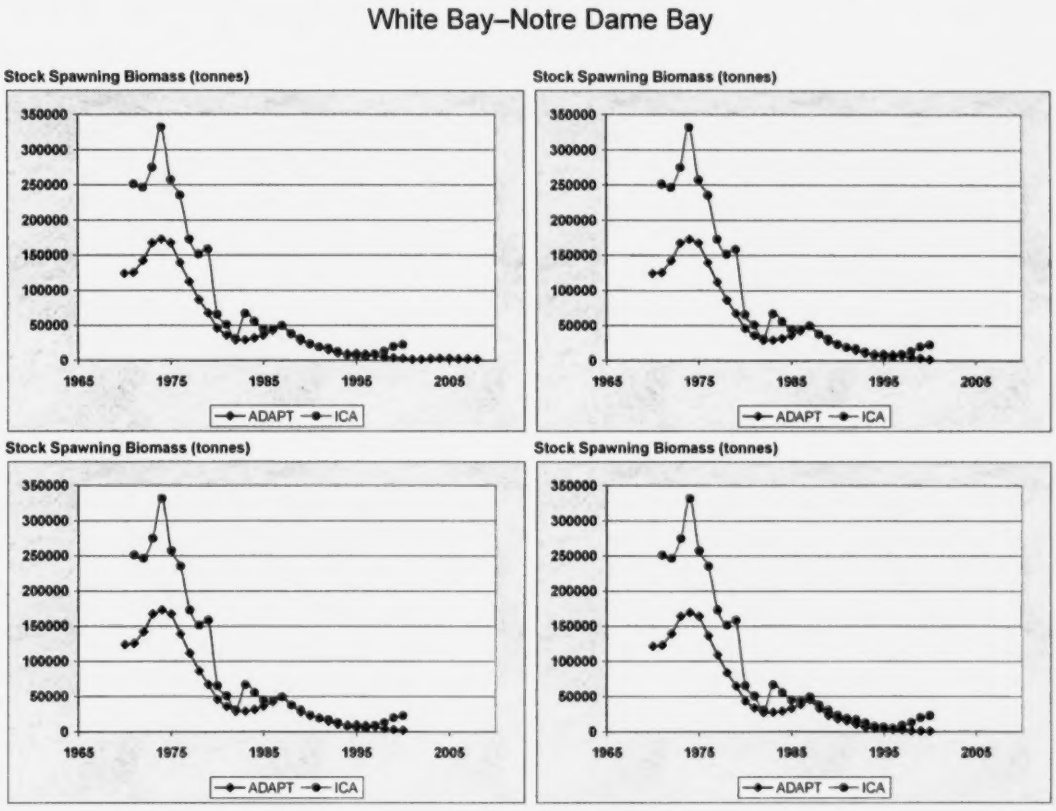


Figure 35. Comparisons of spawning stock biomass from illustrative ADAPT calibrations with age 5+ biomass from integrated catch at age analysis (ICA) (Wheeler et al. 2001) for White Bay–Notre Dame Bay spring spawners:
Top Left: 1970–2008; revised catch matrix; all indices.
Top Right: 1970–2000; revised catch matrix; all indices.
Bottom Left: 1970–2000; revised catch matrix; spring and fall research gill net and acoustic indices only.
Bottom Left: 1970–2000; old catch matrix; spring and fall research gill net and acoustic indices only.

Bonavista Bay–Trinity Bay

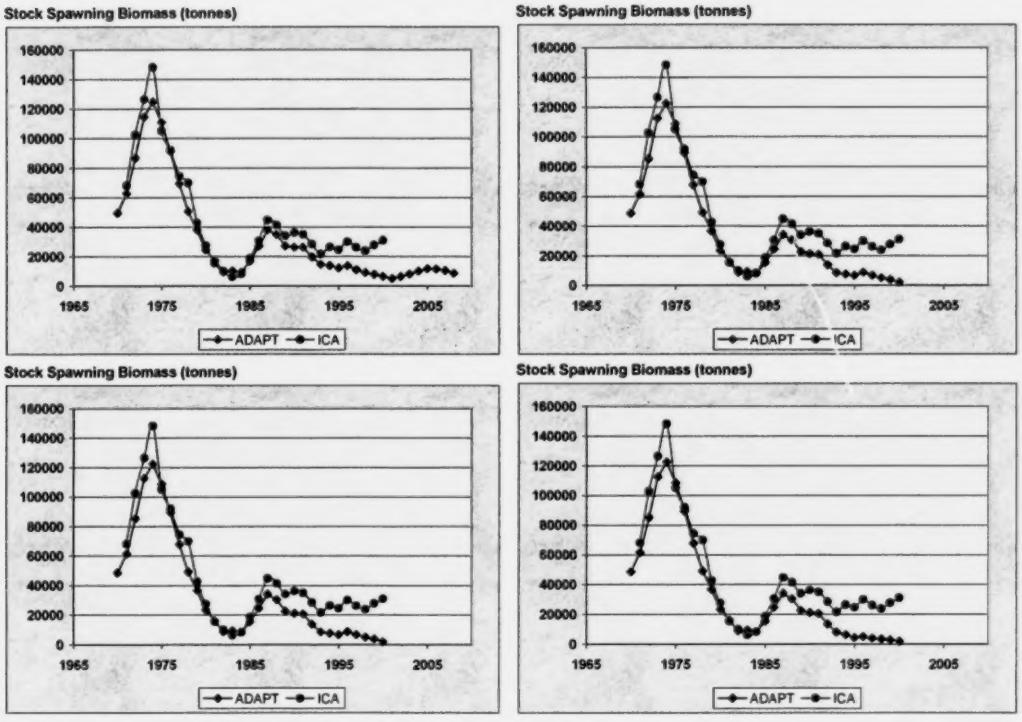


Figure 35 (Cont'd.').

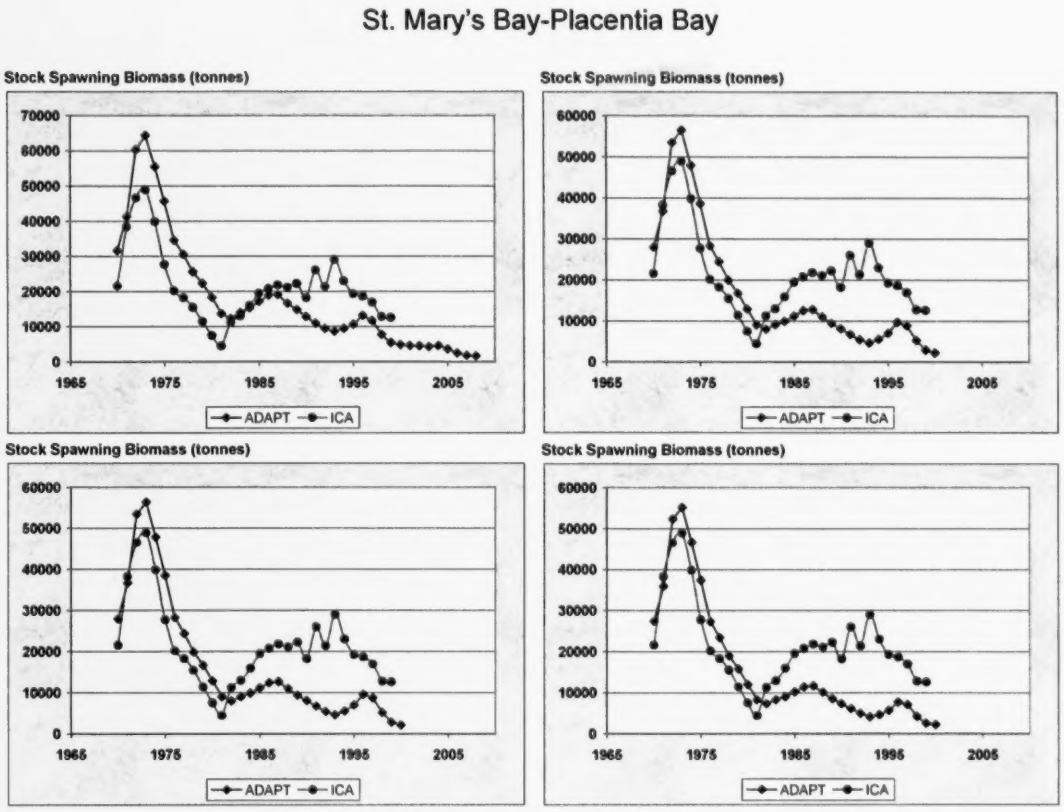


Figure 35 (Cont'd.').

Fortune Bay

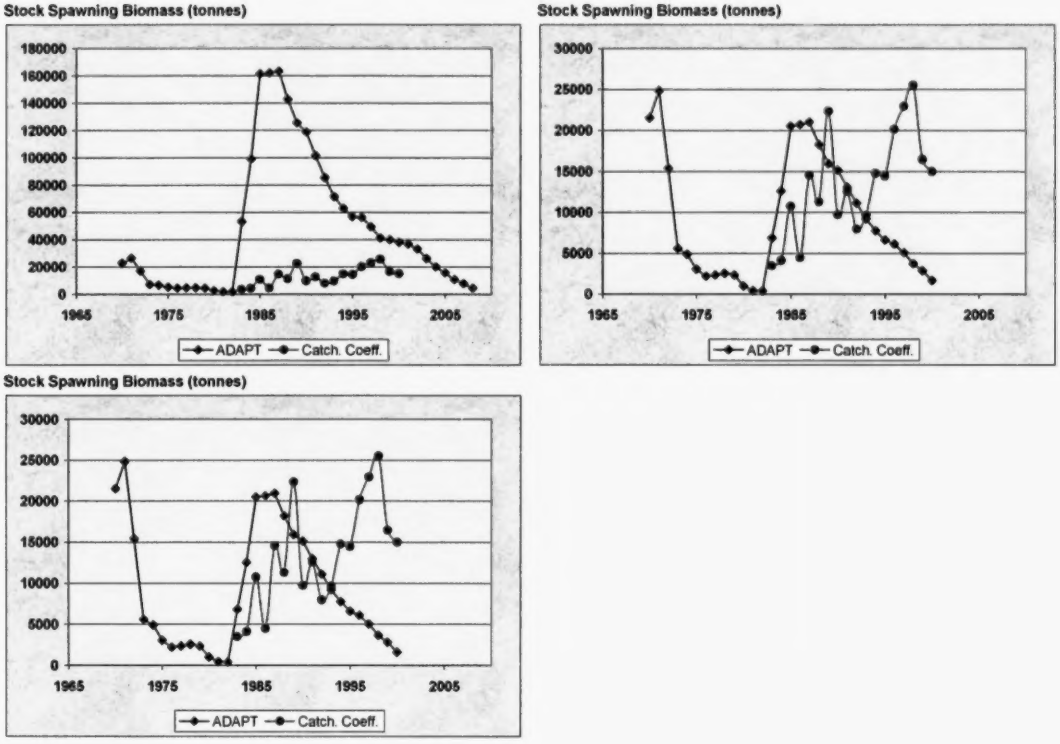


Figure 35 (Cont'd.').

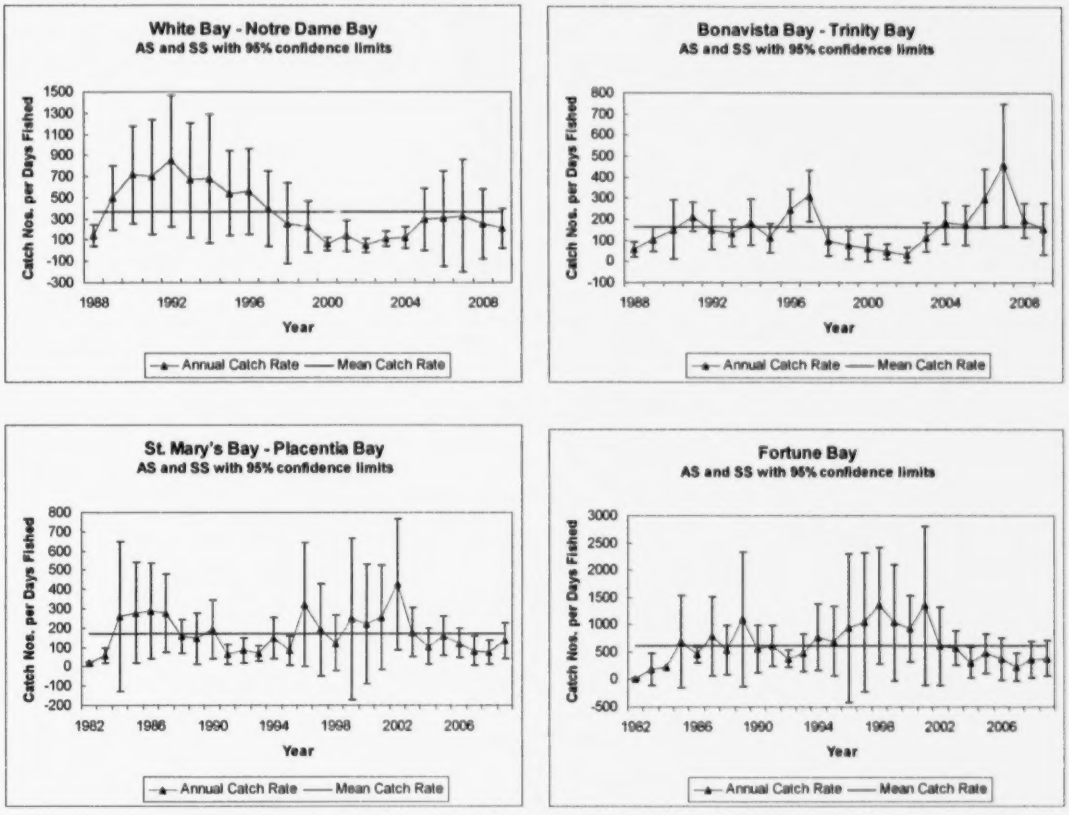


Figure 36. Research gill net catch rates (numbers per nights fished), by stock area and year, spring and autumn spawners combined (with 95% confidence limits).

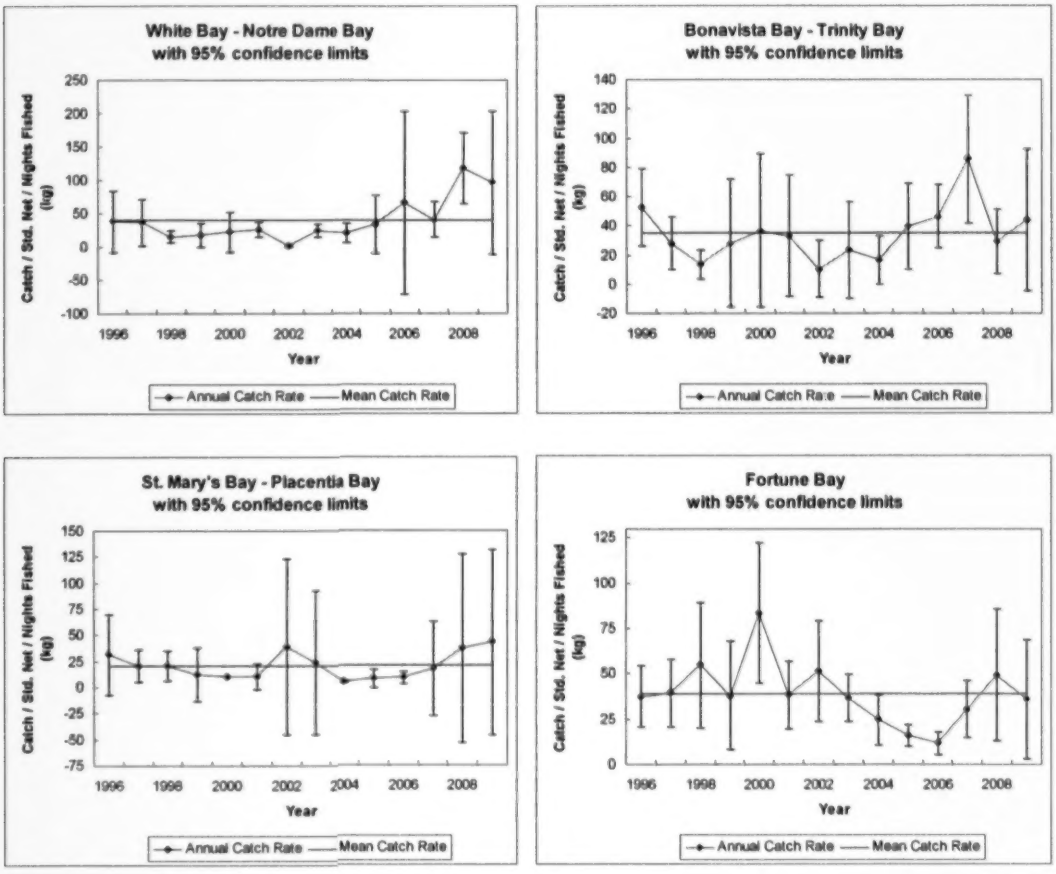

White Bay - Notre Dame Bay
with 95% confidence limits
Catch / Std. Net / Nights Fished (kg)
Year
Annual Catch Rate
Mean Catch Rate
Bonavista Bay - Trinity Bay
with 95% confidence limits
Catch / Std. Net / Nights Fished (kg)
Year
Annual Catch Rate
Mean Catch Rate
St. Mary's Bay - Placentia Bay
with 95% confidence limits
Catch / Std. Net / Nights Fished (kg)
Year
Annual Catch Rate
Mean Catch Rate
Fortune Bay
with 95% confidence limits
Catch / Std. Net / Nights Fished (kg)
Year
Annual Catch Rate
Mean Catch Rate

Figure 37. Commercial gill net logbook catch rates (kgs per standard net per nights fished) and confidence limits, by stock area and year, spring and autumn spawners combined.

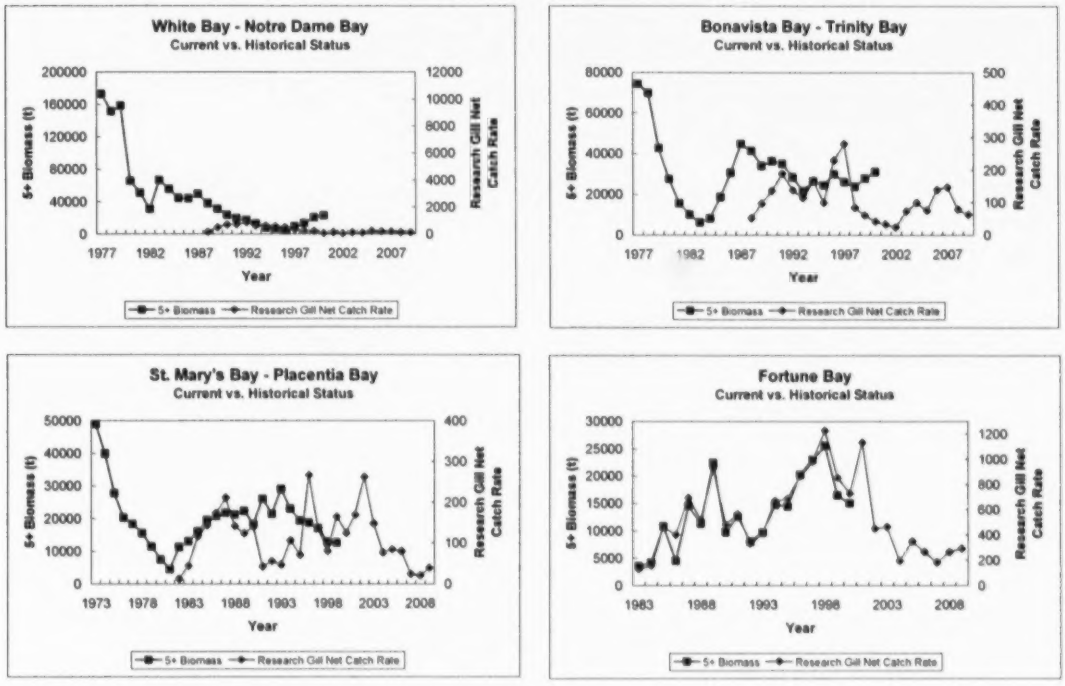


Figure 38. Comparison of research gill net catch rates and historical biomass estimates, by stock area.

Appendix 1. Commercial gill net fisher comments from logbooks, by stock area and community, 2008-09 (communities listed sequentially from north to south).

Year	Stock Area	Community	Comment
2008	BB-TB	St. Brendan's	Herring stocks in this area appear to be in good shape the last two years.
2008	BB-TB	St. Brendan's	Herring catches have remained close to the same as they were 10 years ago. Tuck seines on the longliners are taking herring in the bottom of the bay in April.
2008	BB-TB	Spillar's Cove	The water temperature was a lot warmer this year compared to 2006 and 2007. With the right winds and water temperature, there are still lots of herring around.
2008	CB-SS	Aquaforte	There is no amount of herring here since the seiners were around many years back.
2009	WB-NDB	Beachside	Herring were scarce in this area. There were 6 days when herring catches were good. I had to buy bait because herring were scarce.
2009	WB-NDB	Leading Tickles	Had to take nets up because the water was very dirty (May 19th).
2009	WB-NDB	Bridgeport	I only fished for a few days this season for bait purposes only. When herring showed up around the 6–7 June, there were good catches in this area.
2009	WB-NDB	Moreton's Harbour	There were lots of herring in June. Herring do not come to this area as they did 15–20 years ago.
2009	WB-NDB	Boyds Cove	There were plenty of herring in Boyds Cove this year.
2009	WB-NDB	Change Islands	I fished herring just for bait purposes. There were lots of herring most of the season. Many fishermen had their nets sunk with herring. They would salt that herring and the take their nets up for a while.
2009	WB-NDB	Island Harbour	Herring were netted for bait purposes only. This year herring were abundant.
2009	WB-NDB	Frederickton	I fished for lobster bait only. I've seen a big increase in herring in the last 3 years. They even get into cod nets in the fall.
2009	WB-NDB	Lumsden	Herring don't usually hang around in this area for very long but this spring herring were plentiful and stayed around for the whole season.
2009	BB-TB	St. Chads	Herring were plentiful early in the lobster season but they only stayed for a short while. Water temperature may have been a factor.
2009	BB-TB	Plate Cove West	I could not catch enough herring to feed a gull this year. The largest catch I has was 55 herring and the smallest was 2 herring. I took my nets up in disgust. The water was very dirty all spring.
2009	BB-TB	Bonavista	I never put my net out early because of ice. I think that the herring fishery run until the end of the lobster season, rather than closing at the end of June.
2009	BB-TB	Petley	I fished for 4 days in early May for bait. I took the net up as there was too much cod in it. I only caught a few herring.
2009	BB-TB	Chance Cove	Water was dirty; only now warming (June 30th). I don't care how abundant any species is; it will not net in cold dirty water. Water temperature is very important.
2009	BB-TB	Heart's Content	The water was very dirty all year.
2009	BB-TB	Winterton	Herring seem to be on the decline now. There seems to be more herring in the fall than in the spring.
2009	BB-TB	Winterton	This year was the least herring I have ever seen in my area. We

			had to go to Green's Harbour to get some for bait.
2009	SMB-PB	North Harbour (PB)	There were a lot of herring in the bay in January and February until the seiners came in from the Burin peninsula and Marystown area and cleaned the bay out of herring. There was a small amount came in to spawn in May. I got enough for bait.
2009	FB	Fortune	Herring have been declining every year for the past 7 or 8 years. When you have seiners taking herring out of Long Harbour by the millions, you don't expect the herring to be there when you go back the next year. I fish herring for bait in Stones Cove. For the past 7 or 8 years, you can see the numbers drop. I have fished cod on Long Harbour bank for 30 years. I have a fish finder on my boat and beyond 8 years ago, you could pick up herring all over the bank. The herring were abundant, plenty of them. In June Back 9 years and beyond, herring spawned all along the shore line and you didn't have any trouble getting bait for the lobster fishery. When the seiners are taking millions of pounds out and leaving thousands of pounds on the bottom to rot, that's all you can expect.
2009	FB	Garnish	There were more signs of herring around this year than the last 3 or 4 years. The herring were still full of spawn on June 11th.
2009	FB	Garnish	Beginning about 5 years ago, our catches of herring in fixed nets started to decline. What used to be a healthy source of lobster bait has now dwindled to a miniscule amount. A similar situation occurred back in the 1960's and is now repeating itself. The prime cause is over exploitation by the major purse seine operations.
2009	FB	St. Bernard's	I've been giving comments but it seems to be no good as there is nothing coming from it. Nothing is being done about the longliners fishing herring. You need to do something about them; they are only getting 6–8 cents per pound. They are destroying it for nothing.
2009	FB	Harbour Mille	Herring stay off in deeper water until the middle of June in this area.
2009	FB	Rencontre East	There are too many herring being caught in Long Harbour. Each licence holder should have their own quota.
2009	FB	Pools Cove	In 2009 I had to buy 95% of my herring for bait due to the fact that herring are being caught in Long Harbour. They don't get a chance to come to these small coves because they are overfished in Long Harbour.
2009	FB	Belleoram	There were not many herring in our area this year. The nets were full of slub all of the lobster season.
2009	FB	Belleoram	I started fishing in 1983 and this was the least amount of herring in that period.
2009	FB	Wreck Cove	We got a lot of herring in a short period of time. They then moved off and were scarce. The bottom in some areas was covered with herring spawn.
2009	FB	Harbour Breton	Herring were less abundant in 2009 than in 2008.

Appendix 2. Commercial gill net fisher comments from the 2009 phone survey, by stock area and community (communities listed sequentially from north to south).

Year	Stock Area	Community	Comment
2009	WB-NDB	Coachman's Cove	Herring scarce this year. Herring mixed with mackerel in August.
2009	WB-NDB	Round Harbour	Herring scarce at first but picked up later in the fall.
2009	WB-NDB	Middle Arm	Lots of herring late September. Not much earlier. More this year than last year.
2009	WB-NDB	Middle Arm	Lots of big herring and mackerel in late September.
2009	WB-NDB	Jackson' Cove	Small herring in spring. Big herring in fall.
2009	WB-NDB	Smith's Harbour	Lots of big herring in spring. More around in the fall and bigger.
2009	WB-NDB	Beachside	Same as last year.
2009	WB-NDB	Beaumont	Herring more plentiful last year but good size herring in the fall.
2009	WB-NDB	Beaumont	No spring herring. Nice sign of herring after lobster was over. Lots of herring now.
2009	WB-NDB	Miles Cove	No spring herring. Good bit of herring in the fall mixed with mackerel.
2009	WB-NDB	Brighton	Herring scarce in spring. Plenty when lobster over.
2009	WB-NDB	Glovers Harbour	No herring in spring. Lots in fall. Herring in deep water drove by seals
2009	WB-NDB	Leading Tickles	A lot more herring around last year.
2009	WB-NDB	Leading Tickles	No herring the spring. Lots now in the fall. Big herring mixed with mackerel.
2009	WB-NDB	Cottrell's Cove	Herring scarce. Didn't show up until late June.
2009	WB-NDB	Cottrell's Cove	Herring scarce this year. Had to buy bait.
2009	WB-NDB	Botwood	No herring in the spring. Lots of big herring mixed with mackerel.
2009	WB-NDB	Embree	Lots of herring and mackerel in area now. (Late September).
2009	WB-NDB	Moreton's Harbour	Most Herring seen for years.
2009	WB-NDB	Moreton's Harbour	Herring picked up last 3-4 years. More herring in fall
2009	WB-NDB	Valley Pond	No spring herring but nets sunk after lobster over.
2009	WB-NDB	Valley Pond	Herring scarce in spring last 4-5 years. More around in fall.
2009	WB-NDB	Twillingate	Not much herring spring time. It showed up late when lobster was over. Lots of herring mixed with mackerel in the fall.
2009	WB-NDB	Twillingate	Same as last year. Only had net out one day.
2009	WB-NDB	Durrell	Three or four days of good herring fishing in June. Herring and mackerel mixed in fall.
2009	WB-NDB	Durrell	More herring than last year but showed up later.
2009	WB-NDB	Too Good Arm	A lot if herring and mackerel in this area this year.
2009	WB-NDB	Change Islands	Herring numerous in fall.
2009	WB-NDB	Herring Neck	Herring scarce in spring. More herring and mackerel around in September.
2009	WB-NDB	Herring Neck	A little more herring this year than last year.
2009	WB-NDB	Herring Neck	Herring are better now than in the last three or four years.
2009	WB-NDB	Change Islands	Herring numerous in fall.
2009	WB-NDB	Fogo	Lots of herring close to shore this fall. Catching herring in the food fishery.
2009	WB-NDB	Island Harbour	Lots of herring in this area this year.
2009	WB-NDB	Island Harbour	Herring returning to area. Lots around now.
2009	WB-NDB	Barr'd Islands	A lot more herring this year than last year. First year ever

			saw gannets diving for herring.
2009	WB-NDB	Deadman's Bay	Lots of herring last two years.
2009	WB-NDB	Lumsden	Better herring fishing last two years. Stays around longer in spring.
2009	WB-NDB	Lumsden	More herring last year. Picking up over last 4-5 years.
2009	BB-TB	Newtown	Plentiful this year and last year.
2009	BB-TB	Newtown	Lots of herring this year, as good as last year.
2009	BB-TB	Badger's Quay	Better than last year.
2009	BB-TB	Greenspond	Lots of herring past 5-6 years. Caught enough herring in 5-6 days for lobster season.
2009	BB-TB	Wareham	Smaller herring.
2009	BB-TB	Centerville	A little more herring.
2009	BB-TB	Centerville	Same as last year. Fishery has been really good the past 5 years.
2009	BB-TB	Dover	More herring this year than last year. Caught about 600 lbs. per haul. Shared catch with other fishermen.
2009	BB-TB	Glovertown	Not as many herring this year as last year. Cut off first week in June.
2009	BB-TB	St. Brendan's	Herring has been increasing for the last 5 years. Took in one net and tied up other net once or twice a week.
2009	BB-TB	St. Brendan's	Herring were more plentiful and larger. There were also lots of herring last year.
2009	BB-TB	Salvage	Fishery was the same as last year. Good at start of season but slacked off in mid June-July.
2009	BB-TB	Salvage	Same as last year. Seiners are destroying too much herring by not taking entire catch aboard.
2009	BB-TB	Salvage	Seemed to be more herring last year.
2009	BB-TB	Culls Harbour	Same as last year, lots of herring.
2009	BB-TB	Cannings Cove	Same as last year, scarce but larger herring
2009	BB-TB	Cannings Cove	Same as last year, not very plentiful. Water seemed colder this year.
2009	BB-TB	Musgravetown	Really poor numbers in our area.
2009	BB-TB	Musgravetown	Descent fish.
2009	BB-TB	Princeton	No herring around last 5 years.
2006	BB-TB	Open Hall	A lot less than last year. First two weeks in June were good but not much after that.
2009	BB-TB	Summerville	Scarcer and smaller.
2009	BB-TB	Tickle Cove	A lot less than last year. Took nets out after 2 weeks because there was no fish.
2009	BB-TB	Charlottetown	Lots of herring this year as in previous years. However not much in the nets. Water was dirty.
2009	BB-TB	Duntara	Lots of herring last year compared to last year.
2009	BB-TB	Duntara	Like last year, very few herring this spring
2009	BB-TB	Stock Cove	A lot less than last year.
2009	BB-TB	Bonavista	Landings are down last 4-5 years. Other side of bay is better.
2009	BB-TB	Port Rexton	Scarce. Hard to get bait last 10 years.
2009	BB-TB	Petley	Should increase quota.
2009	BB-TB	Clarenville	Same each year.
2009	BB-TB	Clarenville	Herring is scarce.
2009	BB-TB	Long Cove	Better this year.
2009	BB-TB	Whiteway	Good size herring.
2009	BB-TB	Cavendish	Good size herring.
2009	BB-TB	Cavendish	Less plentiful.
2009	BB-TB	Heart's Desire	Herring very scarce but a good size.

2009	SMB-PB	Mount Carmel	Something brings herring in later in the year than usual.
2009	SMB-PB	Dunville	Showed up May 15 which is about 2 weeks late.
2009	SMB-PB	Dunville	Showed up later in the bay further.
2009	SMB-PB	Freshwater	Herring are small this year
2009	SMB-PB	Fairhaven	A little less this year.
2009	SMB-PB	Arnold's Cove	Should be left alone by seiners for a few years so they will rebound. Seiners are hard on the stock. The herring are a good size in the fall.
2009	SMB-PB	Arnold's Cove	Good bait fishery now. Afraid that when herring increases, larger enterprises will fish it out again. Don't like to send in fixed gear log books for this reason.
2009	SMB-PB	Garden Cove	Seems to be coming back the past few years. Should have a small increase in quota.
2009	SMB-PB	North Harbour	Herring were a little later this spring.
2009	SMB-PB	South East Bight	Small herring this fall all throughout bay.
2009	SMB-PB	South East Bight	Lots around this year
2009	SMB-PB	Petite Forte	Lots after lobster season and before June ended. Last few years the harbour is full of young herring in the fall.
2009	SMB-PB	Point au Gaul	Herring picked up from last year.
2009	FB	Fortune	Herring should open earlier.
2009	FB	Garnish	Herring in decline last 5-10 years. Seiners in mouth of Fortune Bay clean out fish before they come in.
2009	FB	Garnish	Herring were late this year.
2009	FB	St. Bernard's	Poor bait fishery last 5-6 years. Usually have to buy bait.
2009	FB	St. Bernard's	Herring fishery getting worse. More effort required every year.
2009	FB	St. Bernard's	Worst year yet. Herring being destroyed in Long Harbour (FB). Should do something about it before it is too late.
2009	FB	St. Bernard's	Took up nets after a week. Caught nothing.
2009	FB	St. Jacques	Bar seines in Long Harbour (FB) clean up all the herring before they get to St. Jacques.
2009	FB	St. Jacques	Too much fishing in Long Harbour (FB).
2009	FB	Bay L'Argent	Herring were later this year. Had to go to Long Harbour (FB).
2009	FB	Bay L'Argent	Nice size but late showing up and not plentiful.
2009	FB	Bay L'Argent	Not Good fishing.
2009	FB	Harbour Mille	Later this year compared to last couple of years. A little later showing up. Herring are about the same size.
2009	FB	Harbour Mille	Started slow but lots of herring at end of season. A lot of herring being destroyed by bar seines in Long Harbour (FB).
2009	FB	Terrenceville	Good Herring stock.
2009	FB	Grand Le Pierre	Herring not good. They are being overfished in Long Harbour (FB). Herring showed up later this year.
2009	FB	Grand Le Pierre	Too much herring being caught in Long Harbour (FB).
2009	FB	English Harbour East	Getting scarcer each year. They are in deeper water.
2009	FB	Rencontre East	Smaller and scarcer than 2008.
2009	FB	Rencontre East	Later coming each year. Too much herring being caught in Long Harbour (FB). As well, a lot of young herring being caught.
2009	FB	Rencontre East	Long liners in Long Harbour (FB) destroying the herring. They need to be kept out.
2009	FB	Rencontre East	Had to go to Long Harbour (FB). Too many boats there. Herring don't stand a chance.
2009	FB	Rencontre East	Herring was better in 2008. Too many seiners in Long

			Harbour (FB).
2009	FB	Rencontre East	Downward trend with herring. Long Harbour (FB) is overfished.
2009	FB	Rencontre East	Have to go to Long Harbour (FB). Seiners catch everything before it gets to Rencontre East.
2009	FB	Rencontre East	Wors6t herring fishery ever seen. Everything is caught in Long Harbour (FB).
2009	FB	Pool's Cove	Catches down in 2009 compared to 2008. Herring were ate coming But were a good size.
2009	FB	Pool's Cove	2008 was a good year but 2009 was worse.
2009	FB	Pool's Cove	Stop fishing in Long Harbour.
2009	FB	Pool's Cove	Herring being caught in areas were no herring were ever caught before. Long Harbour (FB) takes away too much herring
2009	FB	Belleoram	2009 was not as good as last year.
2009	FB	Belleoram	Herring were scarcer this year.
2009	FB	Belleoram	Had to go farther down the bay to catch herring. Not enough for bait.
2009	FB	Belleoram	2008 was a better year than 2009. Overall, herring is not as good as it used to be.
2009	FB	Belleoram	Catches getting lower every year. Herring were smaller this year.
2009	FB	English Harbour West	No herring.
2009	FB	English Harbour West	Catches going down last 3 or 4 years and are later coming. A lot of herring is being taken out of Long Harbour (FB)
2009	FB	English Harbour West	A little less herring than last year but a good size. Commercial fishery is doing a lot of damage by smothering a lot of herring. Herring are showing up later in the season.
2009	FB	Wreck Cove	Herring are not there. They are all caught in Long Harbour (FB).
2009	FB	Wreck Cove	Earlier this year than last year.
2009	FB	Wreck Cove	No Herring.
2009	FB	Harbour Breton	Herring comes and goes. Was later coming this year. Used seine in Long Harbour (FB). This was the best year for Bar Seines so far.
2009	FB	Harbour Breton	Catches were lower than last year but were good shape herring but not like they used to be.
2009	FB	Harbour Breton	Herring were very late and scarce in Bay D'Espoir. There were only 2 or 3 good days. Long Harbour (FB) takes much more herring than is shown on paper.
2009	FB	Harbour Breton	Fish stock is in good health.
2009	FB	Seal Cove	Long Harbour (FB) is bad for the herring.

Appendix 3. Purse seine fisher comments from the 2008 fall and 2009 spring fishery phone surveys, by stock area and bay, from north to south.

Year	Stock Area	Bay	Comment
2008	WB-NDB	WB	Quota could be bigger. Plants didn't want herring. Poor weather reduced catches. Herring was spotty in areas. Some small herring showed up in the fall.
2008	WB-NDB	WB	Lots of herring for many years now. Started fishing for mackerel in August. There is enough herring around to support a larger fishery in White Bay. Herring are quiet in September and October.
2008	WB-NDB	WB	Millions of herring but no market.
2008	WB-NDB	NDB	There should be a spring quota. The price is double the fall price. PEI is looking for herring.
2008	WB-NDB	NDB	At times there are lots of herring but the abundance in general is average. There is no real shortage of herring. You just have to be at it at the right time. Saw lots of herring while at the mackerel but couldn't find it later in the year.
2008	WB-NDB	NDB	The quota should be increased.
2008	WB-NDB	NDB	Massive amount of herring around Fogo. The weather was too bad to fish. There should be a spring quota as well as a larger fall quota. Herring mixed with mackerel is a problem.
2008	BB-TB	BB	Started early at herring because there was no mackerel.
2008	BB-TB	BB	Open too early. November 10-15 would be the best time. Quota should be increased by at least 30%. If markets were bigger, the plants would be more interested in herring .Herring are getting larger and you should be allowed to sell whatever you catch.
2008	BB-TB	BB	Nice bunches of herring. The fishery should not be open until approx. November 20.
2008	BB-TB	BB	There could be a bigger quota. December is the best month for herring.
2008	BB-TB	BB	Abundant herring last 7-8 years. Saw herring last January for 9 miles unbroken at 30-40 fathoms thick. Approx. 5000 seals in Bloody Bay Reach around Christmas time.
2008	BB-TB	TB	Herring were late. Lost 100,000 lbs because of confusion with quota.
2008	BB-TB	TB	Found the herring scarce.
2008	BB-TB	TB	Real old fashioned herring. No small herring last number of years The quota should be increased.
2008	BB-TB	TB	Herring was late coming. December is the best month. Herring is in around the rocks in the warm weather. Quota is not large enough. You can't really get a chance to look around much because the quota is caught rather quickly.
2008	BB-TB	TB	Didn't put much effort into the herring fishery. The price doesn't cover the cost of the fuel.
2008	BB-TB	TB	Herring were big but were late coming.
2008	BB-TB	TB	Quota is too small. The herring were late showing up.
2008	CB-SS	CB	Quota should be increased. Should have a spring and fall fishery. In the fall, the season should not open until November 15.
2008	SMB-PB	PB	A lot of herring around Long Harbour (PB), LaManche and Southern Harbour. Small herring were not landed.
2008	SMB-PB	PB	Best ever seen since 1990.In area 10, 3Ps a 35% quota increase wouldn't harm the herring stock. Should not carry over any quotas from the previous year for any fleet. Herring is often not caught due to poor markets.
2009	SMB-PB	SMB	Herring were very late.
2009	SMB-PB	SMB	No herring until June. Lots came but they were late.
2009	SMB-PB	SMB	Why was season closed early?
2009	SMB-PB	SMB	Good size herring but not spawning this year. They are full of red feed.

Appendix 4. Newfoundland East and Southeast Coast-2009 Herring Fixed Gear Logbook

Name:	
Mailing Address:	
Community:	
Postal Code:	
Phone No.:	
F.I.N. #:	
Location Fished:	

Net Mesh Size	Number of Nets Fished per Mesh Size	Size of Each Net	
		Length (fathoms)	Depth (fathoms)
2¼"			
2½"			
$2^{5}/_{8}$"			
2¾"			
$2^{7}/_{8}$"			
3"			

Please answer the following questions as accurately as possible:

1. Using a scale of 1 to 10, with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant (fish numbers) were herring in your fishing area in 2009 compared to 2008? (Check one box).

1	2	3	4	5	5½	6	7	8	9	10	?

2. Using a scale of 1 to 10, with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant were herring in your fishing area in 2009 compared to the last decade (approximately 1995 to 2005)? (Check one box).

1	2	3	4	5	5½	6	7	8	9	10	?

3. Using a scale of 1 to 10, with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant were herring in your fishing area in 2008 compared to the last decade (approximately 1995 to 2005)? (Check one box).

1	2	3	4	5	5½	6	7	8	9	10	?

Comments: _____

_____

_____

Please complete and return to: John Wheeler
Science Branch
Dept. Fisheries and Oceans
P. O. Box 5667
St. John's NL A1C5X1

Appendix 4 (cont.'). Newfoundland East and Southeast Coast 2009 Herring Fixed Gear Logbook

F.I.N.# _____

Month	Day	Number of Nets Hauled and Nights Fished by Mesh Size												Estimated Catch Weight (lbs.)
		2¼"		2½"		2 5/8"		2¾"		2 7/8"		3"		
		# of Nets Hauled	# of Nights Fished	# of Nets Hauled	# of Nights Fished	# of Nets Hauled	# of Nights Fished	# of Nets Hauled	# of Nights Fished	# of Nets Hauled	# of Nights Fished	# of Nets Hauled	# of Nights Fished	

Appendix 5. 2009 Herring Fixed Gear Licence and Bait Permit Phone Survey

Objectives:

1. To determine how many licence and permit holders fished herring gill nets and/or bar seines in 2009.
2. To obtain perceptions of herring abundance and other information from fishers who fished in 2009.

Fixed Gear (Gill Net and Bar Seine) Licences and Bait Permits by Stock Area:

Excluding CB-SS

Area	Total
WB	224
NDB	706
WB-NDB	**930**
BB	282
TB	265
BB-TB	**547**
SMB	63
PB	352
SMB-PB	**415**
FB	**298**
Total	**2190**

10% Margin of Error
80% Response Rate

80%
113
106
101
94
414

Phone Survey Procedure:

- There are 2190 licence and bait permit holders. To achieve a 10% margin of error, and assuming that 80% of fishers respond, 414 fishers must be contacted.
- Each of you will be responsible for contacting approximately 50 fishers.
- Attempt to contact each fisher a maximum of three times; second and third attempts should be on different days and at different times.
- No phone surveys are to be conducted on Sundays.
- To assist in contacting fishers after work hours, an overtime request has been submitted allowing you a maximum of 8 (unconverted) hours to complete the surveys.
- All phone surveys must be completed and coded by **October 15, 2009**.

Phone Survey Questions:

Identify yourself (by name) and indicate that you are with Science Branch of the Department of Fisheries and Oceans.

Indicate that "as part of the assessment of herring stocks, we are contacting fishers who held fixed gear herring licences and/or bait permits in 2009".

1. Did you fish herring for either commercial or bait purposes in 2009? If NO, then thank him/her very much and end the questionnaire.

2. In 2009, did you fish herring for commercial sale or for bait purposes (or both)?

3. In 2009, did you fish herring using gill nets, bar seine, and/or tuck seine? If gill nets, continue with question # 4; if bar seine or tuck seine, continue with question # 6.

4. In 2009, how many nets did you fish?

5. In 2009, approximately how many times did you haul your net(s)?

6. In 2009, approximately how much herring (lbs.) did you catch? If he/she fished both gill nets and bar / tuck seines, record the approximate landings for each gear type.

7. Using a scale of 1 to 10, with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant were herring in your fishing area in 2009 compared to 2008?

8. Do you have any comments regarding the herring stock in your area?

Before completing the interview, thank the fisher for participating and indicate that the information that he/she has supplied will be included in the next herring assessment, to be conducted this fall.

Also remind them to send in their herring fixed gear logbook each year.

Appendix 6. East and Southeast Newfoundland Herring Survey Questionnaire of Purse Seine Herring Fishers (Revised April 2007)

The Pelagic Section of DFO Science collects information on herring stock status using various methods such as research gill net catch rates and commercial gill net logbooks. To supplement these information sources and to quantify the observations of purse seine fishers, this questionnaire is designed to gather information on herring abundance and the purse seine fishery. As we do not have the personnel to be aboard your vessel during the fishery, we are asking that you provide detailed observations. We are contacting all purse seine fishers involved in this year's fishery. Your answers will be confidential and will be combined with the answers of all respondents. The final results will be used in the next assessment of these herring stocks.

The questionnaire will take approximately 5 to 10 minutes to complete.

Questions on Herring Abundance

1. Using a scale of 1 to 10 with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant (fish numbers) were herring in your principal fishing area this year compared to the last decade (approximately 1995 to 2005)?

Ans: 1 2 3 4 5 5½ 6 7 8 9 10 ?

2. Using a scale of 1 to 10 with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant (fish numbers) were herring in your principal fishing area last year compared to the last decade (approximately 1995 to 2005)?

Ans: 1 2 3 4 5 5½ 6 7 8 9 10 ?

3. Using a scale of 1 to 10 with 1 being the lowest, 5½ being average, and 10 being the highest, how abundant (fish numbers) were herring in your principal fishing area this year compared to last year?

Ans: 1 2 3 4 5 5½ 6 7 8 9 10 ?

Questions on the Fishery by Bays Fished

(If more than one bay, answer questions 4-12 for each bay fished)

4. In what bay(s) did you fish herring by purse seine this year?
Ans: _____

5. In what month(s) did you fish for herring this year?

Ans: 1 2 3 4 5 6 7 8 9 10 11 12

6. In what geographical location(s) did you have successful set(s) ie. sets in which herring were caught?

Ans: _____

7. How many directed purse seine sets did you make for herring during the fishery this year ie. successful and unsuccessful?

Ans: _____

8. How many successful purse seine sets did you make ie. sets in which herring were caught?

Ans: _____

9. How much herring (lbs.) did your vessel land this year, including any given to you by other vessel(s)?

Ans: _____ lbs.

10. How much herring did you discard (did not land, sell or give away) this year? If none, go to question 13.

Ans: _____ lbs.

11. What percent of discarded herring do you think survived?

Ans: _____ %

12. Why were herring discarded (order of importance)?

Ans: _____

Comments

13. Thank you for your patience and time. Are there any comments you wish to make on the questionnaire itself or any comments in general?